



# EME

## JOURNAL

*The Last EME Birthday in CFE!  
Read about it in the next issue.*





# EME Journal



The EME Journal is the magazine of the Electrical and Mechanical Engineers, published at NDHQ under the terms of reference of the Director General Land Engineering and Maintenance and the EME Branch Adviser. The purpose of the publication is to disseminate professional information among members and exchange opinions, ideas, experience and personnel news, and promote the identity of the EME Branch.

The EME Journal depends upon its readers for content. Articles on all aspects of the Electrical and Mechanical Engineering System, photographs, cartoons, people news and comments are solicited. Readers are reminded that the Journal is an unclassified and unofficial source of information. The contents do not necessarily represent official DND policy and are not to be quoted as authority for action.

Contributors are asked to submit the original text typewritten, accompanied by a disk in WordPerfect format. Photos should be sharp, glossy black and white or colour prints with captions typed separately. Personnel should be identified in all cases, both text and captions, by rank, initials, surname, trade and unit.

The editor reserves the right to reject and edit any editorial material.

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*See last page to order  
"Canada's Craftsmen at 50!"*



## CWO Breton Receives the Order of Military Merit



Brigadier-General V. Pergat presents CWO Gilles Breton with a letter congratulating him on receiving the Order of Military Merit (Member). Presentation of the actual award was done 10 Nov 93 by the Governor-General, the Right Honourable RJ Hnatyshyn. CWO Breton currently works in DLES 4.



# Colonel Commandant's Comments

by Colonel M.C. Johnston

**H**ave you ever wondered what makes us EMEs tick? What keeps us together? What is the secret of our success? This being our 50th Anniversary and all that, it's a good question to ask. A few days ago, (this is being written in mid-January) a Canadian Junior Hockey team again won gold at the Junior Hockey World Championship tournament. One of the players noted that the top ten Canadian Junior players were not on the team. He said, "we're the no-name team which won! We knew what had to be done and we did it!" That very neatly sums up us EMEs – low visibility, team spirit, no stars, get on with it, do a good job whenever wherever no fuss no muss. Here's a look at what I mean.

"...and they shall be fully combatant in the widest possible sense...". This extract is from the General Order authorizing the formation of RCEME in 1944. It means that we are to be soldier technicians. To understand what this means, just ask one of the recovery mechs on the supply convoys bringing up the rations, fuel, mail and spare parts to our embattled CANBATs in Bosnia today. These supply runs are no rear area moves. They are delayed and threatened at the check points. They are forced to endure long and tortuous routes over secondary roads and mountain trails. They are often subject to sniper fire. When they can't get through, the CANBATs go on hard rations. Just ask the EME technicians serving in the CANBATs.

In Croatia it's not only the supply runs where our soldier skills are needed. During the 1R22eR's move into Sarajevo in 1992, a reconnaissance convoy was bombarded on returning from the airport. A jeep was hit and immobilized. The

column's recovery mechanic, Corporal Joselito Boudreault, was already towing a vehicle with his recovery vehicle. Unhooking it, he came forward, got out, hooked up the jeep and recovered it back to safety – in record time – thus opening up the road again and getting the jeep crew to safety. He was awarded a CDS Commendation.

50 years ago, on D-Day, Craftsman Cliff Brown, the armourer in the Nova Scotia Highlander's Anti-tank Platoon, landed with his unit in the initial assault waves. He fought as a gun number by day and worked as an armourer by night for the first few weeks until the unit came out of the line after Falaise. Also early that morning Captain Proctor Neil landed with his Sherman Armoured Recovery Tank as part of the 1st Hussars. He immediately started recovering stalled and stuck vehicles from the exits from the beach. The next day, Craftsman Adrien Breton landed as part of one of the Beach Recovery Groups. He had only his rifle and his tool box. His job was to try and fix stalled vehicles to help keep the beach clear. RCEME Craftsman were ashore on D-Day in the leading elements of the assault force.

Being "fully combatant" didn't just start with RCEME. In fact it's an idea that's been around for as long as soldiers have had the care of equipment as part of their duties. For example, in 1901 the order authorizing the formation Canadian Ordnance Corps used the term in describing its Armourers, Artificers, and Blacksmiths. Later, in March 1918 during World War One, Artificer Staff-Sergeant A.E. Davis' gun battery was heavily shelled. Five guns were put out of action. After five hours' work under fire, he succeeded in getting four of them back in action. During this time the officer and four gunners were wounded and two were killed. Staff Davis was awarded the Distinguished Conduct Medal.

Individually, Canada's Craftsmen have always had a pride in what they have done. "We moved seven times in six months and the VOR line was never any longer than three vehicles!" said Corporal Daley on returning from Croatia in 1992.

Now, as I travel around and talk to you, I find that, as a group, you are becoming more aware of your accomplishments. One of you, Corporal Demary, told me, "EME was always where the action was". He was referring to EME in the Gulf. He was right. Members of the Branch served everywhere in the Gulf War. Our flag flew on the Iraqi border with the Field Hospital and at the airfield with the CF-18 squadrons. In addition, the ships had EME technicians to maintain the on board anti-aircraft weapons specially fitted for the Gulf.

We are a Branch with a single focus – badge, uniform, job. We fix equipment, whenever, wherever, under any conditions, no questions asked. Wherever there are Canadian Forces bases or stations, you can find an EME workshop; sometimes big, sometimes small. With that and our high esprit de corps you can say that "we are a regiment of very many, very small units – everywhere".

One of the keys to our success is the way we fit in and become part of whatever unit we are in. Often I see on unit notice boards that the airman or soldier of the month is an EME Craftsman. Yet when I go to the workshop area, the walls are festooned with EME colours and badges. This reflects our "two part" loyalty. The first part is loyalty to the unit that we serve and are part of, CFS Gander, 2RCR, 202 Workshop etc. The second part is loyalty to our Branch.



One of my proudest moments as your Colonel Commandant occurred in May 1993, when I went to Cyprus for the UN medals parade of my old unit, the 2RCHA. The regiment was represented on parade by two 50-man guards. The remainder of the regiment remained on duty patrolling the Green Line. As the regiment marched on parade I quickly spotted six Craftsmen in the ranks. Their badges and belt buckles were very distinctive! The medals were presented by three VIPs, one for each rank. Each VIP was assisted by a sergeant carrying the medals on a cushion. One was an EME sergeant. "We don't take over but we are always part of the units we support".

"Though all the maintainers worked hard, they were also notorious for playing hard," recalls Lieutenant Greg Hyttenrauch of his tour in Croatia in 1992. "The first

big social event was the EME day celebration. The maintenance platoons of both 1R22eR and 4CER combined for it. There was a BBQ and a variety of different sports for everyone to participate in. It was a huge success and was just what everyone needed to blow off some steam and reduce tensions."

The camaraderie and informal contact among all ranks that Corps birthday parties, bonspiels, and sports days give us, is the glue that keeps us all together. However, the value goes beyond these events. The team work, leadership and organization needed to set up and run them are the very skills that many Craftsmen have picked up, and are able to use in the work place or on a tough job out in the field. We say "We work hard and we play hard". We could also say, "We work hard because we play hard."

Over the years we have been forced to change our badge and our name. Yet, for 50 years we have proudly kept our separate identity as an engineering corps. In addition, we have never changed our focus. We do a good job wherever we are. We can be counted on. How often have you heard a gunner, sapper, trooper, or rifleman in trouble call out, "...go find the RCEMEs..."

**Arte et Marte.**

## DGLEM's Secretary Receives "Harley Davidson" Medal!



Diane Berlinguette, loyal secretary to DGLEM, was feeling a tad left out one day when there was a virtual parade of military and civilian personnel into the DG's office to receive the SSM, CD, and other fine awards. Fortunately, the keen eye of DLES, Col Normand Nault, always alert for ways to improve the moral of the 'troops', spotted a suitable bauble for presentation. The citation for the first-ever award of the Harley-Davidson Medal reads in part "...for excellence in HOG office fashions and accessories..." Her gang would be proud!



## 26 Svc Bn Wins Colonel MV McQueen Trophy



by Capt Reay

On 17 October 1993, 26 Service Battalion was presented with the McQueen Trophy for 1992/93 by Mrs Neeltje McQueen, widow of the late Colonel M.V. McQueen, OBE, ED, CD. The presentation was held at the Army Service Corps Memorial at CFB Borden, Ontario, where 26 Service Battalion was represented by a small contingent representative of all ranks and companies of the battalion. The McQueen Trophy is awarded annually to the best LFCA Militia Service Battalion.

26 Service Battalion is based in Northern Ontario, with the Battalion Headquarters, Supply and Transport Company, and Administration Company in North Bay. The Battalion Maintenance Company is based in Sault Ste Marie, and the unit has a small detachment in Sudbury. This is the second time the battalion has taken top honours in the LFCA competition, having previously won the trophy in 1989.

Colonel McQueen was the Head of Services for Supply and Transport successively in the 2nd Canadian

Infantry Division, the 1st Canadian Corps, and the Canadian Forces in the Netherlands, from May 1940 to September 1945. The trophy that bears his name was initially presented for competition at the time of the RCASC Diamond Jubilee. Due to the changes in structure and operation of the RCASC, the trophy was retired in 1966, but was re-established for competition in 1976. The trophy is normally presented at the Central Area Concentration (CAC) each year but due to time constraints this year, the presentation was delayed.



# Maintenance at MTSC Meaford

by Capt E.G. Paisley

**T**he Militia Training and Support Centre (MTSC) Meaford is located on the Bruce peninsula, overlooking Georgian Bay. As its name implies, it is a militia training centre with collective training carried out year-round, with particular emphasis on weekends.

The climatic conditions and type of training means long, steady, and hard use of equipment. This, coupled with minimum operator maintenance, puts a large burden on the EME maintenance section.

To maintain the equipment there is a nineteen-person EME section very ably commanded by Sgt R Wareham. The maintenance section consists of thirteen Vehicle Technicians, three Weapons Technicians, one Fire Control Technician (Optical), and one each Radio Technician and Administration Clerk. In keeping with the total force concept, seven of the maintainers are reserve technicians, who are all very willing and able to carry out their duties.

The maintenance section is responsible for the first-line maintenance of 16 Cougars, 14 Bisons, 27 HLVW, 34 assorted SMP and civilian-pattern vehicles, and a broad array of ancillary equipment, ranging from chainsaws through generators to snowmobiles. Added to this are small arms, fire control and range finding equipment, communications equipment, and a whole host of shop tools and equipment.

Sgt Wareham has organized the maintenance section using the guideline for a small workshop found in B-GL-314-006/AM-001. Second line maintenance is furnished by Base Maintenance Borden in the form of MRT's dispatched to Meaford or the backloading of equipment to CFB Borden.



*The present maintenance facility at MTSC. The five large doors on the right are the base supply spare parts portion of the facility.*

Recovery is an important part of the craftsman's life in Meaford. The recovery vehicle presently in use is the HLVW variant; however, at times the HLVW is inadequate due to climate, soil, and training conditions, and the maintainers are patiently awaiting a Bison MRT.

Presently, the EME craftsmen work out of a hangar shared with Base Supply and the PERI staff, who use a portion of it for a mini-Gym. Conditions in the hangar are far from ideal; in fact, some would call them primitive. However, under the able leadership of Sgt Wareham, the EME craftsmen provide excellent service to the users, always ensuring the maximum amount of equipment is serviceable and available for militia training.

Sgt Wareham and his maintainers have built an excellent rapport with the user, which has proven to be beneficial to both.

The future plans for Meaford are very ambitious. New buildings, new ranges, a battle group's worth of vehicles and equipment, and an increased training load consisting of gun camp, driver training, and QL3 and 4 training, all mean a larger role for the EME Technicians.

While the present maintenance facility is not perfect, the future facility will be a modern workshop in all respects. Designed from the ground up to cater to all maintenance functions, both first- and second-line, the new complex will include 40 vehicle bays and workshops, and is scheduled to be completed in 1995. The building will have appropriate office, washroom, and storage areas for all



activities. The vehicle bays and workshops will be fully equipped for their respective maintenance functions.

Along with the new expanded maintenance facility will be a much enlarged maintenance cadre, consisting of two EME Officers, eleven Warrant Officers and Sergeants, thirty-nine junior Non-Commissioned members, and twenty-three civilian technicians.

The units that use the Militia Training and Support Centre Meaford are happy with the maintenance support they receive now; they will be ecstatic with the service provided post-1995!

## DGLEM Speaks to Ukrainian Veterans

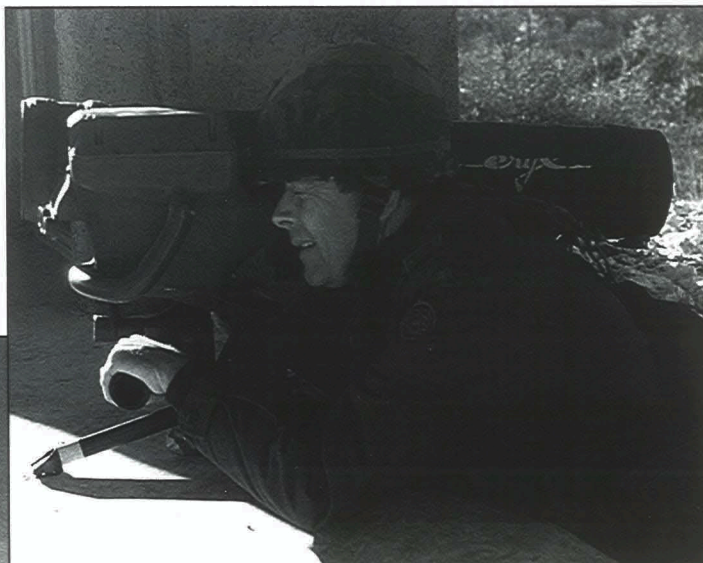


BGen Pergat enjoys conversation with MGen Mulava of the Ukrainian Army at a dinner celebrating the 50th anniversary of the Brotherhood of Veterans of the 1st Ukrainian Division. This division of 10,000 men fought against the Russians in 1943 in the Battle of Brody, suffering 50% casualties in 48 hours. Of the remaining 5000 soldiers, about 2000 emigrated to Canada following the war, and the Brotherhood of Veterans has chapters in Toronto, Montreal, and Winnipeg.



# The ERYX Weapon System

In 1988, Canada and the French Army began cooperating in the evaluation and production of the ERYX weapon system. ERYX is a short range anti-armour weapon system heavy (50 to 600 m), destined to provide a high level of performance in the defeat of all types of current armoured vehicles and those of the future (a picture is worth a thousand words!). The acquisition contract was signed on 23 March 1993.



*ERYX weapon system.*

The main components of the ERYX weapon system are the missile, the tripod, and the firing post which will be equipped with a thermal sight. The system also consists of a tactical container (for missiles), a tactical carrying case (to transport the firing post, the tripod, and the thermal sight), and two types of training simulators.



*Hit against a T-72.*



*Enclosed space firing.*



### Characteristics of the ERYX Weapon System

- Penetration capability > 900 mm RHA(Rolled Homogeneous Armour)
- Probability of hit against a moving target 0.9 (from tripod)  
0.7 (from the shoulder)
- Range 50 to 600 m
- Flight time < 4.2 sec at 600 m
- Weight
  - Firing post 4.5 kg
  - Missile 12.5 kg
  - Tripod 4.2 kg
  - Thermal sight 3.2 kg
- Tandem charge to penetrate ERA (Reactive Armour)
- Wire-guided command to line of sight (magnification of 3)
- Enclosed space firing capability
- Man-portable by one soldier
- Low profile, minimum signature

## Basic Components of the ERYX Weapon System

### Firing Post

The firing post can be used with or without the tripod and comprises the following:

- a. A sight-localizer-guidance computer unit (VLE in French) used for battle-field observation and to generate guidance orders in Very Large Scale Integration (VLSI) technology. The VLE comprises the sight head and electronic cards. With the addition of a thermal sight, the VLE provides for target acquisition and manual guidance of the missile by day, by night and in reduced visibility;
- b. A junction box used to connect the missile to the firing post; and
- c. A firing handle.

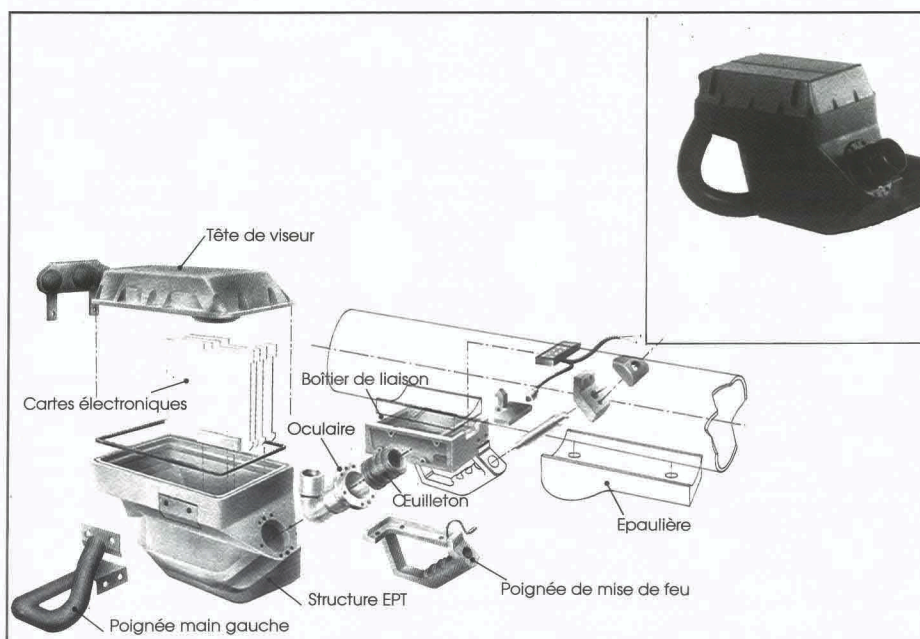
### Operating Principles

The launching of the missile at low speed allows for shoulder firing and firing from confined spaces.

Command to line of sight (CLOS) guidance, the localization of the missile by charge coupled device (CCD) camera, the mode of generation of the guidance orders and the transmission of these orders by wire, all contribute to make the system very inconspicuous and provide it with protection against the natural and artificial jamming encountered on the battlefield.

The thrust vector control system (thrust applied about the centre of gravity of the missile) and the short response time of the missile provide a very high degree of manoeuvring and high accuracy at all ranges.

The tandem charge provides for the destruction of all tanks, even those protected by composite or reactive armour.



Firing Post.



## Tripod

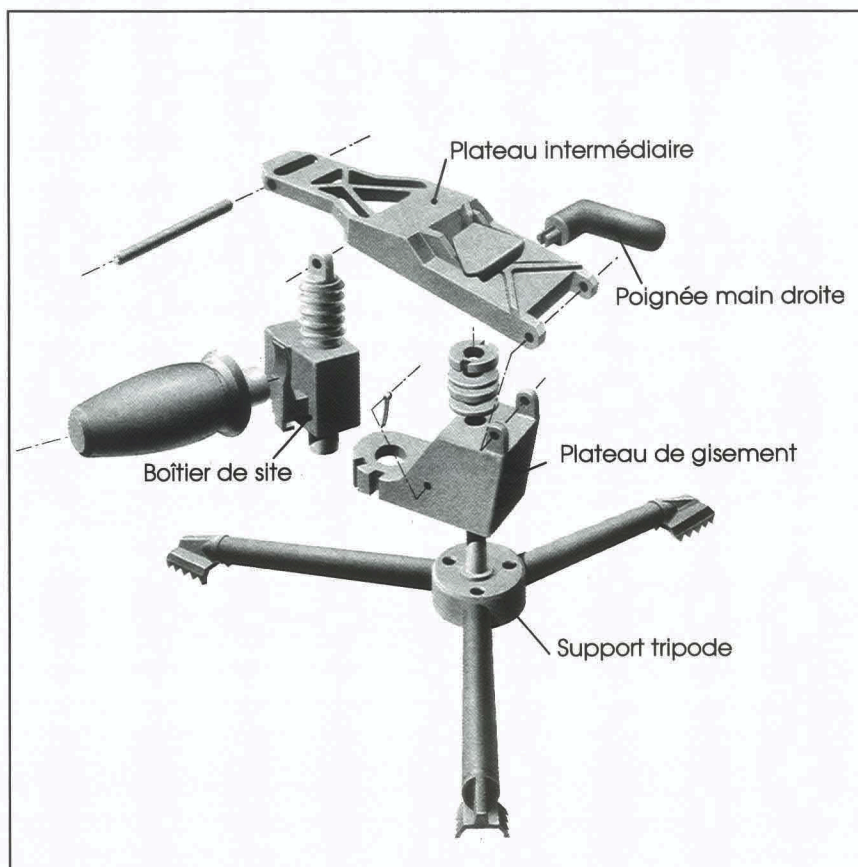
The firing post is only used with the tripod for firing from the prone position.

## Ammunition

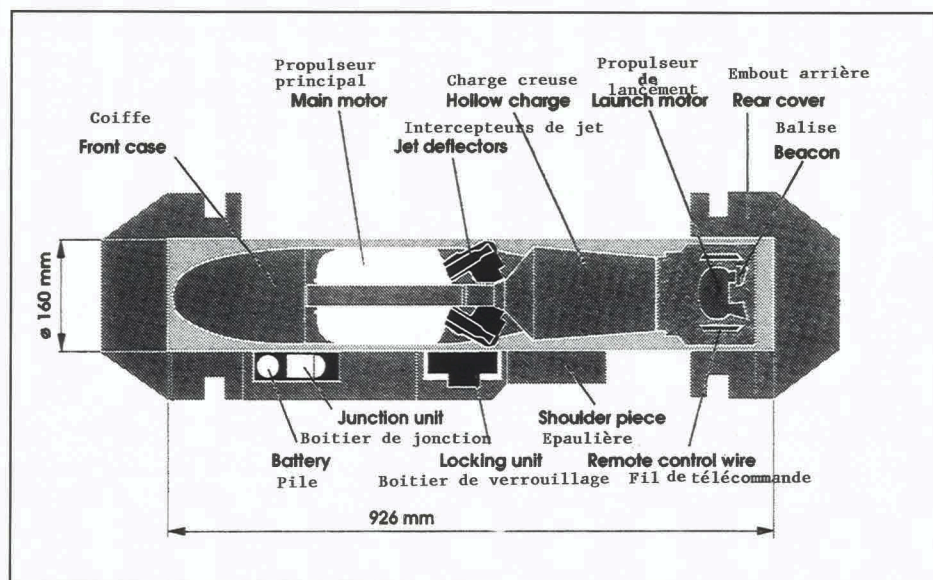
The ammunition comprises the missile in its launch tube. The missile contains:

- a. a main motor located at the front and jet deflectors placed at the centre of gravity for the direct thrust vector control (DTVC) system;
- b. a military warhead:
  - (i) the front charge (small hollow charge) which, as its name implies, is located in the front of the missile. It is triggered by a nose cone crushing when the missile hits the target, and
  - (ii) the main charge (hollow charge) is placed at the rear of the missile, thus improving its effect through optimization of its stand-off distance. It is ignited with delay in relation to the front charge;
- c. a launch motor (propellant grain) designed to eject the missile out of its tube at a low speed (18 m/sec) and to initiate missile rotation;
- d. a splinter infrared beacon for missile localization;
- e. a remote control wire coiled at the rear of the missile; and
- f. a front case which, in addition to the front charge, includes the coding and decoding electronics for missile interface with the firing post, a gyroscope, a safety arming device and a thermal battery to power the missile.

The launch tube can be equipped with front and rear covers and a carriage strap to become a tactical container.

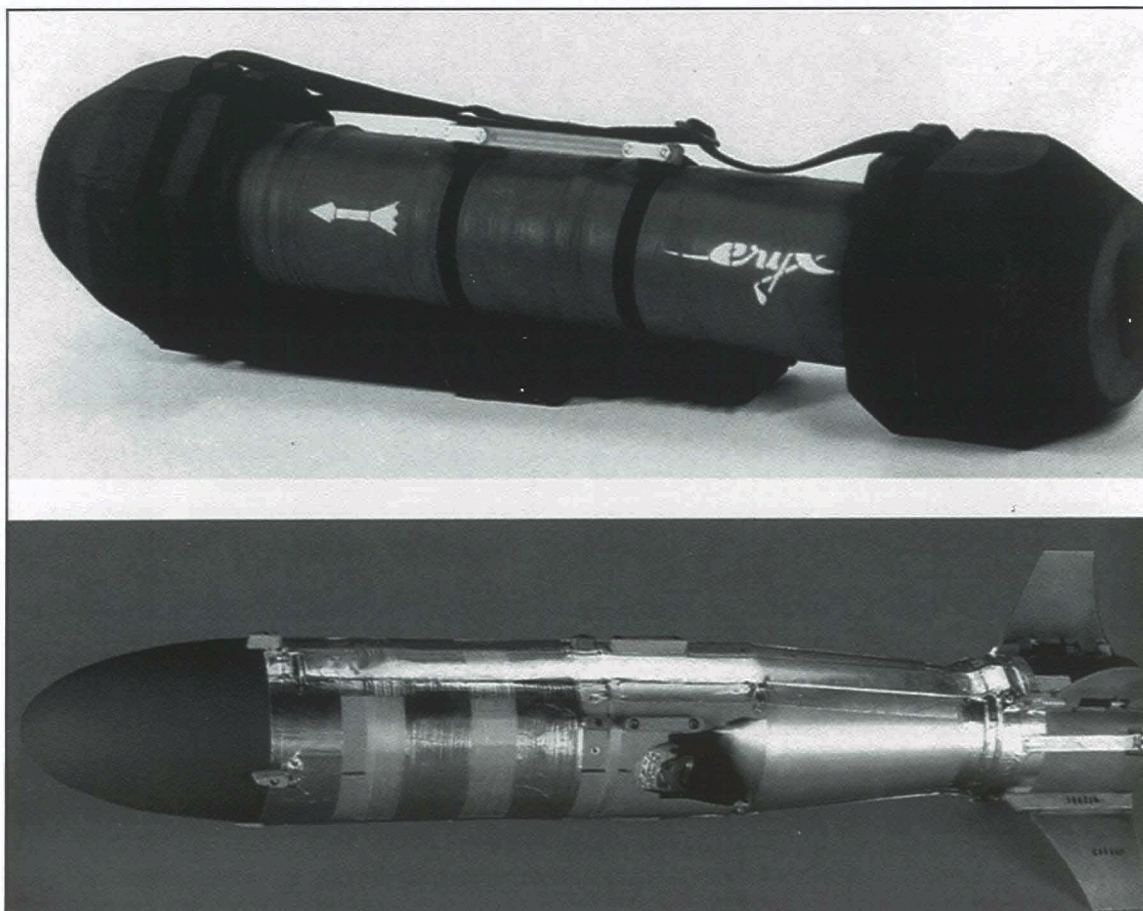


*Tripod.*



*Missile.*





*Tactical container.*

## Thermal Sight

A study concluded that the operational effectiveness of the ERYX weapon is greatly improved by the add-on of a thermal sight capable of penetrating battlefield obscurants. Aerospatiale is responsible for integrating the thermal sight to the ERYX firing post. This sight will project an infrared image through the eyepiece of the day sight mounted on the firing post.

## Classroom Simulator

Video interactive technology, property of the Canadian Forces (CF), was selected in the development of a classroom

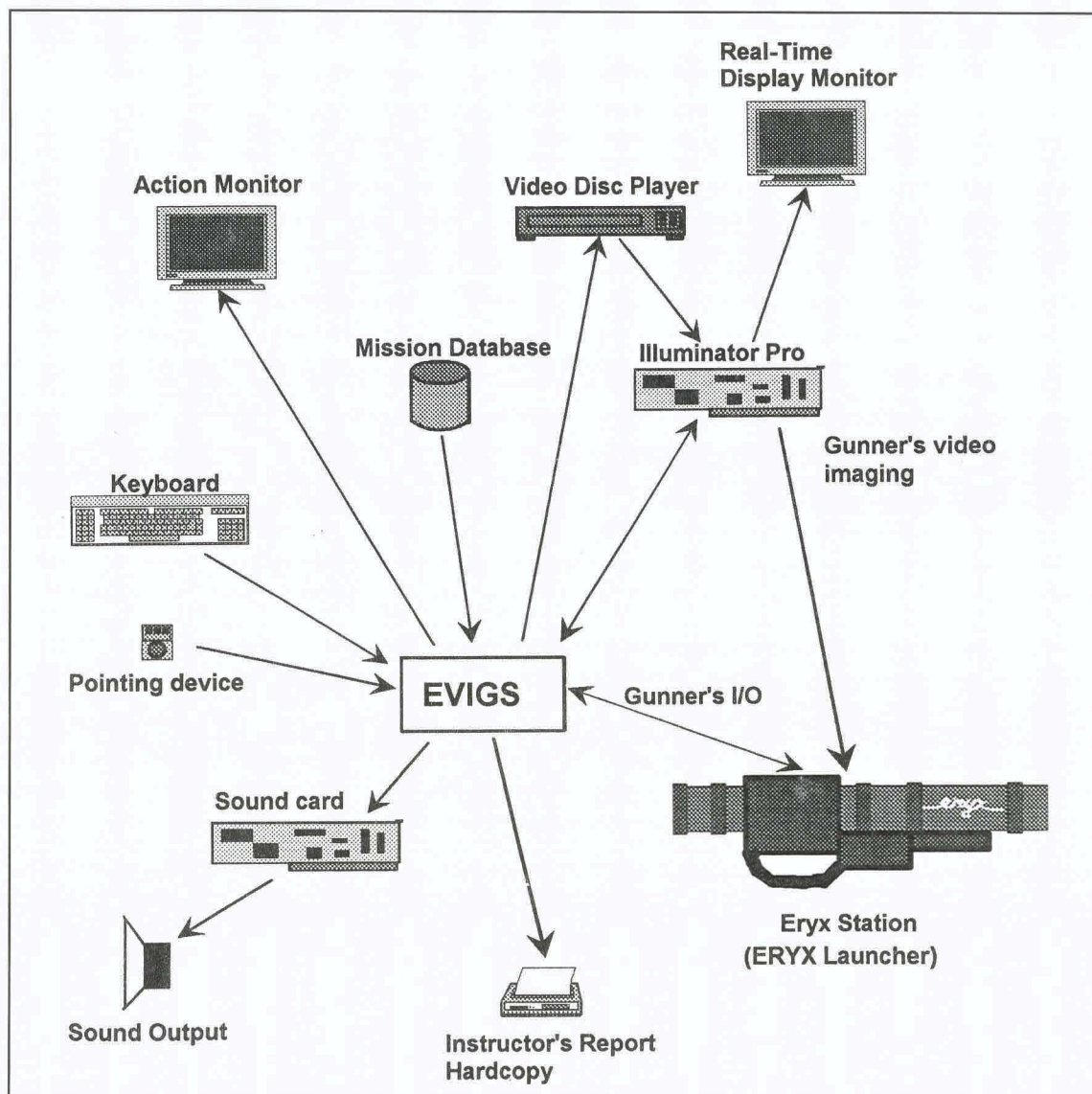
simulator, the **ERYX Video Interactive Gunnery Simulator (EVIGS)**. The EVIGS will be a compact and portable classroom training device. The gunner's station will replicate the physical positioning and characteristics of the firing post assembly (tripod, firing post and launching tube) and of the ERYX missile. The instructor shall control the selection of the mission and initialize parameters with the aid of a user-friendly interactive graphical user interface. The gunner will execute a mission from parameters supplied by the instructor, and the EVIGS will display all video and graphic images and environment effects (fog for example). It shall process all of the gunner's input

and monitor real-time performance data which shall be displayed on the instructor's video monitor. The EVIGS shall also generate a report of the gunner's performance during the mission.

## Tactical Simulator

The ERYX Precision Gunnery Simulator (EPGS), a tactical simulator designed to meet individual and force-on-force training requirements, is in the development phase. The EPGS will be a two-way eye-safe laser system which will be MILES (Multiple Integrated Laser Engagement System) compatible. It will enable ERYX teams equipped with a PGS system to destroy vehicles equipped with the PGS





EVIGS.

and/or to be destroyed by other PGS systems according to a realistic destruction hierarchy.

The EPGS will reproduce the size, weight, configuration and functions of the ERYX weapon system, including day and night sighting. This includes a realistic reproduction of launch noises and unburdening of the missile.

### Tactical Carrying Case

The tactical carrying case will be used to transport the firing post, the thermal sight and the tripod. This case will also provide a certain level of protection against electromagnetic pulses (EMP).

### Missile Rack

Each M113 A2 and armoured vehicle general purpose (AVGP) used to transport the ERYX weapon system will be equipped with one missile rack with a storage capability of up to four missiles.



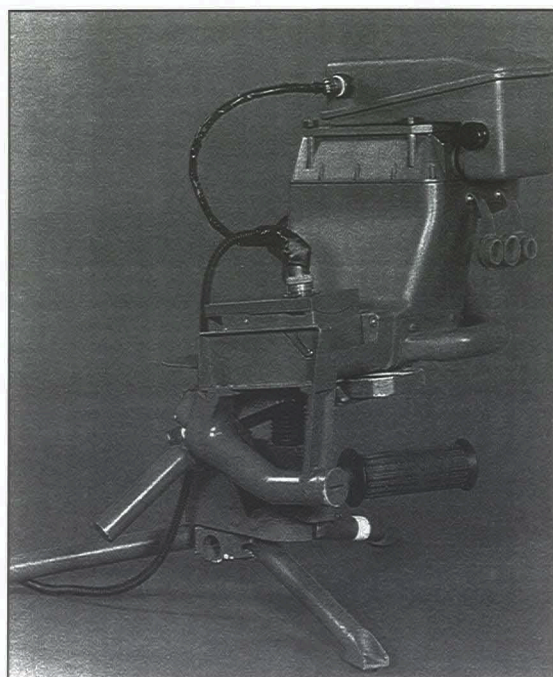
## Integrated Logistic Support (ILS)

### Maintenance Equipment

DND will procure a diagnostic device to rapidly detect, diagnose and isolate failure causes at first and second line. Moreover, the thermal sight, EVIGS, EPGS and test kit will be equipped with an integrated failure diagnosis system.

**Ammunition.** The ammunition requires no maintenance.

**Firing Post.** A test set called MES (moyen externe de soutien) will be used to carry out maintenance tasks on the firing post. The firing post can be tested without disassembly. Tests are carried out to ensure that the firing post is operational and to locate failures in the optics head assembly (firing post electronics) and the VLE. If the test is positive, the firing post is deemed operational. If the test is negative, the firing post must be repaired by replacing defective sub-assemblies.



MES.

### Distribution and Milestones

DND will acquire, from the French contractor Aerospatiale, 425 firing units (firing post, thermal sight and tripod) and 4,500 missiles (including 500 inactive missiles).

In February 1995, a first unit will be equipped with the ERYX weapon system. Each infantry battalion will get 36 firing units (three per platoon). The assault platoon of the reconnaissance squadron of Armoured Regiments will get four firing units. Each 10/90 battalions in the reserve will get 18 firing units.



## “You’ve Done WHAT to My Guns”

**Simulators.** The two types of simulators (EVIGS and EPGS) will be delivered at the same time as the ERYX weapon system, i.e., early 1995. DND expects to buy 50 EVIGSs and 54 EPGSs.

**Thermal Sight.** Delivery of the thermal sight is expected one year after delivery of the ERYX weapon system, i.e., early 1996. All 425 firing posts will be equipped with a thermal sight.

**Tactical Carrying Case.** The tactical carrying case will be delivered with the ERYX weapon system. Combat and training units will receive one carrying case per weapon system.

**Missile Rack.** Missile racks will be delivered at the same time as the ERYX. Vehicles used to transport the ERYX weapon system will be equipped with one missile rack each.

*The following tale from the WWII Italian Peninsula Campaign was passed on to us by Jim O’Brien:*

### Time Frame (1943-44)

“Russell, ten years my senior, had, a few months previously, taken his engineering degree. Passing from his university’s C.O.T.C. contingent, he arrived at the RCEME School for a good brush-up prior to embarkation overseas.

And thus by rail, ship, bus, truck, jeep, and pedestrian hikes, he arrived at Tac HQ of the Canadian Field Regiment of Artillery (25 Pounder), to which he’d been assigned as RCEME Rep, including L.A.D. duties.

The officers of the unit being absent on “O” Gp some miles distant, he was shown around the wagon lines by a senior NCO and was bade welcome – then left to his own devices for the afternoon and evening stretching out before him.

Noting many of the vehicles (Fd Arty Tractors in the main) in sorry mechanical shape – they being much punished by desert, Sicily, and peninsular exercises – he ordered vehicle mechanics to strip down some thirty or so, laying out in neat piles clutch facings, brake shoes, and other components he deemed to be in their “last quarter of useful life”. And thus it was the Colonel discovered

on his return in the pale moonlight that the “new officer” had effected significant repairs – reducing to zero the probability of response by the guns on tomorrow’s first light – at a brigade support location some 35 miles northward!

Well, Sir!

Summoned urgently to meet with the CO, Russ took a ten-minute “rocket”, whose central theme was that no one knew better than the Colonel the lamentable state of vehicle health in the unit at that time.

But did the Lieutenant before him understand that he, the Colonel, was now in the dicey position of getting eight guns into action on time – while seeking an extension of time to see the remaining gun groups into action?

Russ matured in those ten minutes, becoming in later days and months a useful and popular unit officer.

The Colonel, dismissing him from their critical “discussion”, turned with a faint smile to the tactical maps from which evolved the operation orders to come.

I say a faint smile – as the Colonel undoubtedly recalled that he too had once been a subaltern, and junior at that!”



# Ammunition Safety

## Not Just for Peacetime!

*The following article, reprinted from the U.S. Army Ordnance Bulletin, is well worth reading and reflecting upon by readers of the EME Journal, in particular for the insights it offers into the Army requirement for munitions with lower susceptibility to initiation by unintended stimuli, i.e., Insensitive Munitions (IM). Also highlighted is the need to have ammunition technical knowledge available to unit commanders, who must decide on temporary storage arrangements for ammunition under their control.*

**D.H. Gladstone**

**A**lthough most people are not aware of it, 11 Jul 91 is a significant date in Army history. This date is significant because it marks the occurrence of the most expensive accident in Army history, excluding storm damage at Fort Hood, Texas, in May 1989. This catastrophic accident in Southwest Asia almost decimated an entire battalion-size unit, resulting in 58 injuries and the loss of more than \$40 million worth of supplies, property and equipment.

Although this accident was not caused by ammunition, the magnitude of the accident was directly related to the involvement of conventional ammunition. If not for the ammunition, this accident would have been a combat vehicle fire, with a resulting monetary loss of less than \$200,000.

The unit had returned from a field exercise the day before, and crews were downloading vehicles for maintenance. Ammunition was placed on the ground behind the vehicle it came from.

While preparing to clean the air filters of an M992 field artillery ammunition support vehicle (FAASV), a crewman

discovered a fire in the forward part of the crew compartment. The vehicle was fully uploaded. Although unit members did not have the equipment needed to fight a fuel fire, they did their best with what they had until small explosions began going off in the FAASV. At that time, all personnel were ordered to evacuate the area.

About 45 minutes after the fire was discovered, the first high-explosive projectile detonated. Within minutes, the ammo on the ground and in other vehicles began detonating. In less than an hour, the unit had lost almost all its vehicles.

The accident injured 58 people, destroyed 30 tracked and 54 wheeled vehicles, and damaged 30 tracked and 47 wheeled vehicles. A few days later, two soldiers were killed and another was injured in an explosion during cleanup operations at the accident site.

As is the case with virtually all accidents, many events combined to produce the conditions that led to this accident. The heater fire inside the FAASV was only the source of ignition. Improper decisions, poor communication, and failure to perform to standard caused a relatively

minor vehicle fire to result in terrible consequences. These factors started a long time before the accident occurred.

The unit staff had conducted its initial reconnaissance of the compound site about a week prior to the unit's arrival. Ammunition storage was one of the major issues identified during this recon. An ammunition officer and a quality assurance specialist-ammunition surveillance (QASAS) recommended that the ammo be stored away from the compound because the area did not allow for adequate separation. The unit chain-of-command did not accept this recommendation. It felt that the unit's ammo needed to be immediately available, that storing the ammo on a separate site would pose security problems, and that sapper attacks posed a greater threat to the compound than the ammo being stored there.

About a month before the accident, a member of the unit staff discussed the ammo storage problem with representatives from the support command (SUPCOM). During this meeting, it was mentioned that the unit being replaced had kept its ammo uploaded on its vehicles. The problems involved with storing the ammunition away from the compound were also discussed. The unit staff officer perceived this conversation as SUPCOM approval of ammo storage on the compound, and he briefed it this way to his chain of command.

As a result, the unit stored its entire ammunition basic load (ABL) on its compound. This consisted of more than 450 short tons of ammo uploaded on vehicles, sitting on the ground, and stored in MILVANS. The compound had, in fact, become an ammunition supply point.



The unit needed a waiver from the theatre commander to store its ammo in this manner, and it didn't have one. Although the compound was visited by QASAS personnel and SUPCOM ammunition staff officers, neither provided the unit with formal guidance on storing its ABL on the compound. During the investigation, the theatre commander indicated he had never been informed the unit was storing its entire ABL on the compound. The unit commander acknowledged that he had made the decision; however, he was not aware this required a waiver from the theatre commander.

So, communication problems between the unit and the SUPCOM resulted in some information not being fully understood, while other information was misinterpreted. There were also communication problems between the unit and SUPCOM staffs and their commanders.

Because the commander is the decision-maker, he must be given all the information and options, even those that are perceived to be unpopular. The SUPCOM ammo staff attempted to work the problem at the staff-officer level to maintain harmonious relations with the unit. The issue of where to store the ammo was a standard risk-management decision; however, neither the SUPCOM ammo staff nor the unit ammunition officer ensured that the commander had the information needed to make this decision.

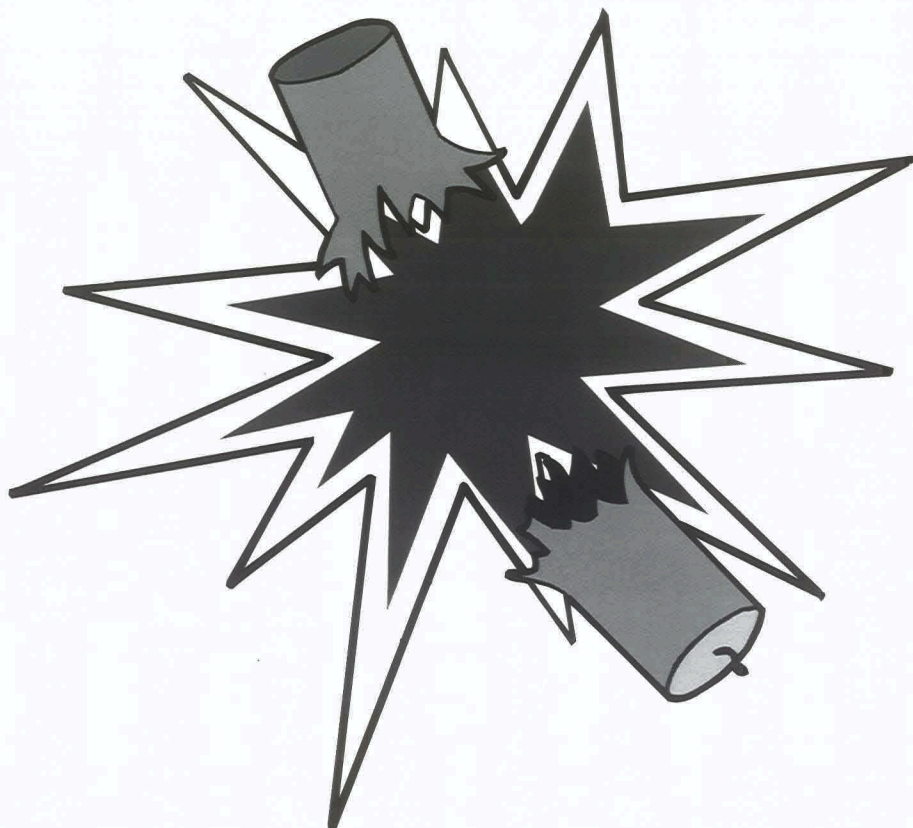
There was a lack of communication among units on the compound. There were several Army units, along with some allied units, stationed on the compound. These units had never established any common radio or wire communications net or emergency alarm system. As a

result, the word to evacuate had to be spread by runners. Some units were not told to evacuate until the ammunition began to explode.

The unit violated the separation and storage standards outlined in AR 385-64, Ammunition and Explosive Safety Standards, and in TM 91300-206, Ammunition and Explosive Standards. The unit's failure to comply with these standards placed not only itself at risk, but also the other units on the compound. The compound hospital was located within the fragmentation radius of the unit motor pool. When the ammunition began to detonate and personnel began to get hurt, the hospital became unusable because of flying fragments and falling debris.

The unit was aware it was violating explosive safety standards; however, it felt that storing the ammo on the compound was an operational necessity that outweighed safety concerns. In addition, the unit did not implement measures to reduce risks associated with storing ammo on the compound, such as parking armoured vehicles in such a way that they would serve as barriers and restrict propagation of an explosion.

Enforcing ammo separation standards and providing risk-management decision information are routine actions performed by ammo officers and NCOs during peacetime. The factors that should have been considered and the standards that should have been applied have been taught in officer and NCO development courses for years. This accident is an expensive example of what can happen when we don't follow the rules and we don't perform to standard.





# Katie Lives!

*Sgt L.J. Nearing*

The Hastings and Prince Edward Regiment, a local militia unit located at the Belleville Armouries, was fortunate enough to acquire a 1942 Universal Carrier. It was destined to be a working display at their Regimental Museum, with one problem: it was very far from being in working condition!

The regiment contacted the OC EME Sqn at 8 Wing Trenton, Major Rick Johnson, and asked if we could help. The technicians jumped at the chance to work on an Army vehicle that was as much as 30 years older than they were!



*Mr Dick Terry and Scott Terry preparing to perform some creative metal working.*

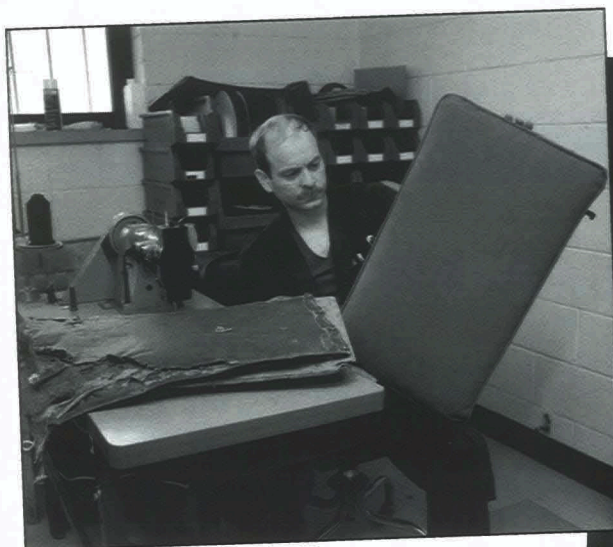


*MCpl McDonald honing Katie's engine cylinders.*

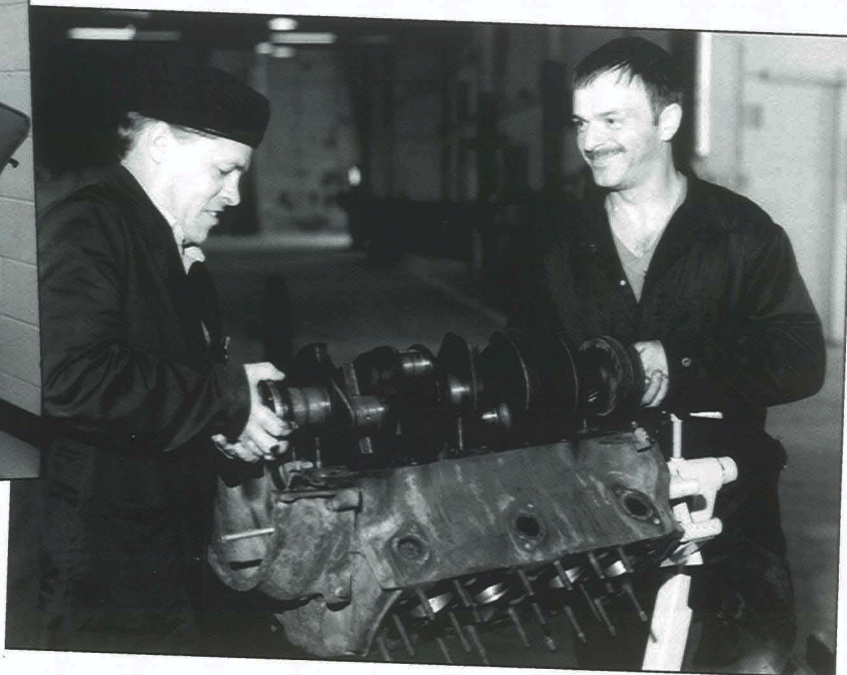


*Left to Right: Sgt Nearing, Cfn Fife, Mr Scott Terry, Mr Richard Terry, MWO Divins, Maj Johnston, WO Smith, Cpl Orford, Cfn Lautamus, Mr Bill French, MCpl McDonald, Cfn Allhusen.*





Sgt Nearing with old(sitting on table) and new seat for Katie.



Sgt Williams and MCpl McDonald disassembling Katie's engine.



Left to Right: Mr Bill French, MCpl McDonald, Cpl Orford.



The Universal Carrier was commonly known as the Bren Gun Carrier because of the machine gun it carried; this example was one of 28988 produced by the Ford Motor Company of Canada between 1941 and 1945. They were widely used by Canadian, British, and Commonwealth forces during World War II, and many were purchased for farm and timber work at the end of the war. The exact history of Serial No. 11257 is unknown.

When No. 11257 arrived at EME Sqn, the engine was knocking badly, and the hull was showing signs of years of exposure to the elements. The technicians, during their spare time, completely disassembled the vehicle. When the engine was torn down it was discovered that a piston connecting rod had gone through one of the cylinder walls.

The parts call went out to Canadian Tire, but they advised us that they no longer stock 1942 V8 85 hp flat-head engines! The previous owners were contacted and they happened to have a spare block. This cancelled the wooden block #7 cylinder theory.

Rebuilding the engine, metal work, upholstery, and painting took approximately 500 hours labour.

A photograph in the Hastings and Prince Edward Regiment's Museum was found to have a Bren Gun Carrier with the name "Katie" stencilled on the hull, so No. 11257 adopted the name. All those who devoted their time and knowledge to this project were invited to a remembrance service and dedication of the Carrier at the Belleville Armouries, where "Katie" was driven onto parade in front of a large number of WWII veterans and local dignitaries. "Katie" is now on permanent display at the Armouries.



*Major Johnson with the Universal Carrier Dedication Plaque.*



# On Leadership

*Editor's Note: This article was written by Cdr Manfred Kling, BESC, MS, OE, CD, Commanding Officer of Naval Engineering Unit Pacific. Leadership qualities naturally transcend trade or environment, and his ideas, whether you agree with them or not, provide good food for thought.*

It is essential to the MARE classification that we have among us leaders at every level who possess the skills, abilities, and attitudes that will enable them to successfully carry out the responsibilities of their offices in the furtherance of the interests of the classification and the navy. Those from whom we expect this must be guided early in their careers to develop certain essential leadership qualities and must be given opportunities to mature them.

The most important quality of a leader is loyalty – to those he serves and to those who serve him. He must at the same time have the wisdom to understand that disagreement is not necessarily disloyalty, and that one who, in the best interest of the service, disagrees, should be listened to. A leader should not feel threatened by capable contemporaries or subordinates. Rather, he should be wise in selecting them to achieve those things which can be attained only through strong and motivated subordinates.

A leader must also have the courage to accept the risks of leadership and to act with confidence in times of uncertainty. He must have the fortitude to carry out difficult assignments and be committed to persevering in the face of opposition. He must be decisive, knowing when to be firm and when to compromise; but over-eagerness must be tempered with preparation, experience, and opportunity.

A leader must develop empathy – an appreciation for, and an understanding of, the values of others; a sensitivity for other cultures, beliefs and traditions. He must be able to anticipate thoughts, actions and consequences; a skill learned by observation and through instincts sharpened by experience.

The quality of unyielding drive to accomplish goals is a desirable and essential quality of leadership, as is the intrinsic desire to win. It is not important to win all the time, only to win the important issues (bounded always by moral and ethical principles). Through training and experience a leader can develop a personal feeling of assurance with which to meet the inherent challenges of leadership. Pertinacity is often the key to success. However, while exhibiting self-confidence, a leader must be cautious not to take on an aura of false pride or arrogance. He must be willing to learn, to listen, to grow in his awareness and ability to perform the duties of his office, and to accept the simple fact that he will need to work every day to become a better leader than he was yesterday. This can seldom be accomplished without tremendous effort or sacrifice of other interests.

A leader must be credible and dependable. His words and actions must be believable. He must be trusted to have the intelligence and integrity to provide correct information and to be dependable enough to carry out his roles and responsibilities. He should understand that those serving above and below him are counting on his ability to lead, and he must be proud of having been entrusted with such a responsibility. He must have the essential quality of stewardship, a caretaker quality, and must serve in a manner that encourages confidence, trust and loyalty. Subordinates must not be abused, rather they must be guided, developed, and rewarded for their performance. Discipline must be reserved as a consequence of last resort and applied sparingly. Without subordinates there can be no leaders. Leaders are therefore caretakers of the interests and well-being of those people, and the purposes they serve.



*“And a young warrior said: Speak to us of leadership. An he answered saying: These are my innermost thoughts on leadership I give you, so that you and your subordinates might be better prepared to lead.”*

A leader must be determined to apply common sense in solving complex problems and must understand that success will often depend largely upon sustained willingness to work hard. Sweat generally rules over inspiration! He must never accept an office of leadership for which he is not willing to pay the price necessary to fulfil its obligations.

And finally, a leader must exercise great care to avoid placing otherwise capable people into positions of leadership that they have no desire to fulfil.

These, in my view, are the characteristics of a leader. It must be recognized that this not a comprehensive list and that leaders will be of no composite character. They will be as different from one another as one person can be different



from another. They will not be laden with all human virtues, nor will they possess a flawless character. However, committed leaders, those with a willingness to serve, will be distinguishable by their wisdom, sincerity, benevolence, authority, and courage. They will have a human quality and a strong commitment to their cause and to those they serve.

### **Post Scriptum**

Copies of the essay "On Leadership" were offered anonymously (by the author) to a group of young MARE trainees for comment. As you will see, their views provide interesting food for thought. I am pleased they did not pull their punches since the article was intended to spark discussion. If we are to mature as leaders we must each, at some point in our career, reflect upon and strive toward those qualities we believe to be important.

**"Being believable is not good enough, one needs to be thoroughly truthful."**

Author's reply: I fully agree that one must be truthful. Intrinsic to believability is truthfulness; indeed, the dictionary defines "believable" *inter alia* as "putting trust in the truthfulness of a statement."

**"I disagree with 'selecting subordinates wisely'. A leader does not always have this luxury. He should be able to take any subordinate and work with the strengths and weaknesses to obtain the desired results."**

Reply: I couldn't agree more. Perhaps a better turn of phrase would have been, "...he should be wise in selecting among his subordinates to achieve those things which he can only attain through strong and motivated subordinates." This embodies the concept that each person has special talents which must be recognized and encouraged if he is to achieve and demonstrate his full potential.

**"It is not important to win. It is important to learn from the experience and be able to analyze why you lost. A leader should put forth the arguments to the best of his ability. If a (contrary) decision is made by his superior, he must be willing to accept his leader's decision and get on with the job."**

Reply: Learning from experience and being able to analyze why you lost subsumes the principle that you want to win next time. I agree that winning is far less important than "giving it your best shot". However, there are issues for which you must be prepared to fight, and be determined to win, even in the face of opposition. What those issues are will depend on the circumstance. Never forget that senior officers base their decisions on staff work. They are not always right, and they rely on you to have the courage to tell them when they are wrong. Having said this, you may infrequently come across those who believe that wisdom and knowledge are directly proportional to rank, in which case be silent and learn from the experience.

**"The author brings up some good points but he has a very idealistic view of a leader. The author should state more about how one goes about obtaining all these qualities. There needs to be a balance between the effort to become a good leader and other aspects of your life."**

**"The author talks of 'sacrifice of other interests'. How far is he willing to go? What interests is he talking about? Is his family included in his list?"**

Response: These two comments touch on the question of personal values, one of the most difficult subjects to tackle. Values change with time (for better or worse!), according to the culture and the circumstances. It's not that long ago, after all, that most people would have agreed with the statement "Queen and country above all." Today, this form of thinking is seen far less frequently. But, where do you draw the line between sacrifices for your country and devotion to your family and friends? Must the good of the majority outweigh personal interests? I have my opinions on these questions, and I encourage you to form your own. To answer them requires a good dose of introspection, and to act in accordance with your beliefs requires courage.

**"The most important quality of a leader is the ability to make a decision. Nothing is worse for a leader than to have his subordinates believe he is indecisive."**

Response: In effect, indecision can have a harmful effect on the ability to lead. It causes doubt not only about the ability of the leader to give firm and clear orders, but also about his other qualities, such as courage, emotional stability, and the confidence he inspires. It is, however, disputable that one quality is more important than another. You may be right that ability to make a decision, or any other leadership quality, could be ranked higher than loyalty. However, my opinion is that I could work with a non-decisive person and still have confidence in him, but could never have confidence working with a disloyal person.



# Laser Cleanroom Requirements

By Captain Derk Duermeyer

**A** while ago we published several articles in the Leopard Newsletter on the following topics:

- a. "The Importance of Desiccation and Pressurization of Optical Instruments"; and
- b. The follow-up and answers to the article listed above.

Given the exacting nature of laser cavity/resonator environmental requirements, and cleanroom workstation requirements while the laser system is undergoing repair at a maintenance facility, it seems logical, if not necessary, to provide detailed information on these requirements.

## Degradation of Optical Elements Within the Laser Cavity/Resonator

Optical and mechanical components located within a laser resonator are extremely sensitive to foreign dust particles and rapid environmental changes such as temperature, relative humidity and atmospheric pressure.

A solid state Q-switched laser, such as the IFCS sight of the Leopard C1, is capable of generating pulses of electromagnetic radiation of extremely high peak powers. The energy levels within the laser resonator, during the pulse buildup, can set up electric fields of similar magnitude, which binds atom to atom in the materials from which the optical elements are made. Thus, anything which tends to give rise to discontinuities within the optical beam deposits contamination on the optical

surfaces, or ineffective adhesion of anti-reflective coating to optical elements and non-homogeneous films, can set up fields in which obliteration or burning of materials occur.

In view of this, every effort must be made to ensure the ultimate cleanliness of mechanical components and optical reflective surfaces during cleaning and maintenance procedures by optronics technicians. In addition, it should be noted that some optical materials are sensitized by the high level of electromagnetic radiation and react later when moisture is present within the laser cavity, either within the pores of the metal casing, or the internal environment itself. Thus, every effort must be made to ensure a dry environment be maintained within the laser head itself during operation. In other words: desiccate the laser cavity at regular intervals with the approved nitrogen. This will ensure that ultimate optical component life will be achieved.

The burning or etching effect on optical elements within the laser resonator will greatly reduce the energy output of laser systems. Subsequent firing of the laser under these conditions continues to degrade the system, making it necessary to set the pulse forming network (PFN) rotary switch on the laser power supply to an increasingly higher position. More importantly, continued operation of a laser under such conditions will rapidly deteriorate the optical components, to the point at which they are permanently damaged and non-repairable. This condition usually requires a laser rod replacement and Q-switch tuning. This is both costly and time consuming, as it usually takes 18 to 24 months lead-time to obtain laser rods from the manufacturer.

Similarly, the presence of acid from finger prints on the flash tube will cause burning damage on that surface, and

reduce energy output. Furthermore, fungus growth or a thin film of moisture which is deposited on the reflecting or refracting surfaces of the laser resonator components will act as an antireflective coating, which greatly reduces laser energy transmission.

## Prevention of Degradation

The degrading or damaging caused within a laser optical cavity or sighting system can be reduced, or virtually eliminated, by the application of proper maintenance techniques and work habits described in our previous articles. It is amazing to know that technicians, and their supervisors, do not fully appreciate what a tremendous detrimental effect a dirty environment has on optical sighting and laser systems. Failure to accept this fact has in the past cost us hundreds of thousands, if not millions, of dollars. Something must be done to make our technicians and supervisors alike understand requirements and environmental conditions necessary to carry-out optical and laser repairs at all maintenance levels.

Here it is; the following environmental requirements, precautions and equipments are necessary when cleaning and maintaining a laser optical cavity/resonator:

- a. Cleanroom environment of Class 10,000;
- b. Horizontal flow laminar workstation of Class 1,000;
- c. Temperature of 18 to 25 degrees Celsius;
- d. Humidity of 40 to 60 percent RH;



- e. The technician must wear a laboratory coat, gloves, head dress and protective foot covers;
- f. Only skilled FC technicians (MOC 433) or their civilian equivalent, will carry-out the repairs;
- g. The technician must practice good house keeping and display good work habits;
- h. The work area(Laboratory) must have an ante-room so that personnel who are to perform the tasks will be able to clean and prepare themselves and the equipment to be worked on prior to entering the cleanroom environment;
- i. All external parts and tools used must be extremely clean prior to placing it into the laminar flow workstation;
- j. To prevent breaking laser rods or flash tubes, soft rubber placemats covered with clear and clean plastic, such as "Saran Wrap", will be placed on the working mats and working platform of the laminar workstation;
- k. Never inspect optical or mechanical components outside the confines of the laminar workstation, or remove the complete open laser from the workstation while the covers are removed. Similarly, never leave the optical components uncovered or leave the cover off the laser while the workstation is not in the operating mode. Many technicians tend to forget this important precaution;
- l. To prevent scratching of laser rod reflective ends, pumping cavities and other optical elements, the complete laser cavity must be pre-cleaned with bursts of pure nitrogen (99.998 percent water free), NSN 6830-21-883-0329. Compressed air, which contains impurities and moisture is not authorized;
- m. Blow drying or cleaning with nitrogen will be carried out within the confines of the laminar workstation only. For this purpose a dedicated nitrogen bottle complete with pressure gauge, regulator, hose and nozzle must be mounted next to the workstation;
- n. All optical elements located within a laser cavity will be cleaned with 99 percent water free "Ketone" only;
- o. Once optical elements, laser rods and pumping cavities have been cleaned with "Ketone", they will again be blow dried with nitrogen;
- p. After blow-drying an optical element, they must be placed under an infra-red light for a five-minute time-period. For this purpose a dedicated infra-red lamp must be mounted within the laminar flow workstation;
- q. Once optical elements have been disinfected under the infra-red light, they will again be polished with lens Paper soaked in "Ketone" and blow dried with nitrogen;
- r. Laser rod ends will be polished using lens paper wrapped around the tip of a clean, small diameter aluminum rod, eg. 1.5 to 2.0 mm in diameter. When wrapping the lens paper around the rod circumference ensure that no acid from the fingers contaminates the paper;
- s. When polishing laser rod ends, small circular motions moving outward from the centre must be used. Thereafter, the rod must be blow-cleaned with nitrogen and disinfected under the infrared light;
- t. Never immerse cotton-batten puffs or other cleaning articles into the liquid used to clean the optical elements. This practice will contaminate all the fluid within the container. Never use the lens paper or cotton puffs more than once, and do not prepare the cleaning spatulas too far ahead of the actual cleaning procedure, as they will collect impurities quickly;
- u. Gold or silver plated reflecting surfaces of pumping cavities are extremely soft and will scratch easily while cleaning. Therefore, always blow the dust or dirt from the cavity with a burst of nitrogen prior to commencing the cleaning procedures. Thereafter, clean the cavity with clean disinfected cotton puffs soaked with "Ketone" using light longitudinal wipes only. Once the cavity is clean, it must be blow-dried with a burst of nitrogen immediately; this will prevent streaks from forming on the surfaces. Do not use lens paper, "Q-tips" or similar cotton swabs to polish pumping cavities as they may be impregnated with dirt which will scratch the reflective surfaces;
- v. Flash tubes will be replaced at a second or third-line maintenance facility only. They will be cleaned and replaced within the confines of the laminar workstation only, in a similar manner as outlined for the other optical elements;
- w. Because the characteristics of each individual laser rod is different, the laser rod of one laser must not be inter-changed with the laser rod of another laser without submitting the laser through a complete series of tests and adjustments; and
- x. Laser optical cavities will be flushed with pure nitrogen for a time period not less than 15 minutes, every 90 days while in service, or when a flash tube is replaced, and/or after a laser has been cleaned at a second or third line maintenance facility.



Class	Measured Particle Size in Micrometers				
	0.1	0.2	0.3	0.5	5.0
1	35	7,5	3	1	N/A
10	350	75	30	10	N/A
100	N/A	750	300	100	N/A
1,000	N/A	N/A	N/A	1,000	7
10,000	N/A	N/A	N/A	10,000	70
100,000	N/A	N/A	N/A	100,000	700

Figure 1. Class limits in particles per cubic foot of size equal to or greater than particle size shown in micrometres.

## Cleanroom and Workstation Classification

We have just stated that in order to repair a laser optical cavity a cleanroom and laminar workstation of class 10,000 and 1,000, respectively, are required. Without these environmental controls, do not even think of opening up the laser cavity, as this will cause an ingress of impurities into the laser cavity, and for the reasons stated in the preceding paragraphs, will cause irreparable damage when the laser is fired.

Now then; what do we mean when we refer to a class 10,000 or 1,000 cleanroom environment? A cleanroom is a room in which the concentration of airborne particles is controlled to specific limits. There are two main types of cleanrooms; an at-rest cleanroom, and an operational cleanroom. An at-rest cleanroom is a facility that is complete and has the production equipment installed and operating, but without personnel within the facility. An operational cleanroom is a facility in normal operation with all services functioning and with production equipment and personnel present and performing their normal work functions. It naturally follows that the greater the number of personnel within the operational cleanroom the less clean air will be

available. Class 10,000 or 1,000 means the number of airborne particles per cubic foot and of a particular size, usually measured in micro-metres. A particle is a solid or liquid object generally between 0.001 and 1000 micrometres in size. Class limits are determined by referring to the table listed in Figure 1.

With reference to our cleanroom and workstation requirements, and the table in Figure 1, we may conclude that our cleanroom environment must provide less than 100,000 particles of 0.5 micrometre in size and less than 700 particles of 5.0 micrometre in size. Similarly, the work-station must provide less than 1,000 particles of 0.5 micrometre in size and less than 7 particles of 5.0 micrometre in size.

A cleanroom environment required for laser repair is hard to obtain, and once in place is hard to maintain at the correct standard. Therefore, we must again refer our technicians and supervisors to our previous articles. Rooms must be properly built and maintained to required standards. The walls and ceilings must be painted with special paint. Drop ceilings must provide isolation from other detrimental environments such as bare concrete; in other words they must be sealed completely

within their frames. The floor tiles must be made of special material, not ordinary tiles which disseminates dust particles continually as personnel walk about in the work area.

## Particle Size Measurement, Counting and Monitoring

Methods of particle size measurement, counting and monitoring, and additional information on cleanroom and workstation environmental requirements may be obtained by referring to US Federal Standard FEDSTD-209C, Dated 27 October 1987.

## Conclusion

If you have stayed with us this far, you must now be convinced that we have environmental problems when maintaining optical instruments and lasers. It is up to you the supervisors and managers in the workshop and in the field to stress the requirements we have listed. Please take heed and implement these procedures to prevent future damage to optical instruments, and, in particular, lasers.

*Capt Duermeier is LCMM of Leopard optics in DVEM 3. Contact him at 997-0674.*



# Advanced Technology Demonstrator

by Major L. J. Phillips  
CFLO TACOM

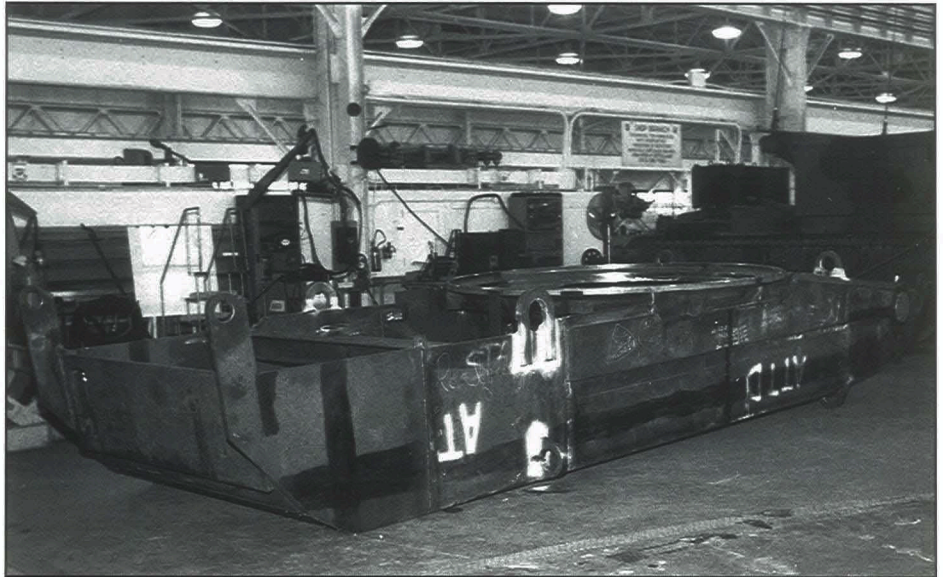
## Introduction

When I first thought of writing this article, many of the long term effects of the end of the cold war had not been fully realized. Downsizing of the American Forces, and the resultant requirement for fewer equipments had not yet entered the picture. The aim of this article at that time was to discuss whether or not the building of advanced technology demonstrators (ATD) was a sound military decision, as opposed to a method of curbing industrial cost overruns (which is in itself a sound decision in any field).

The realities of the shrinking defence budget and the newest US defence acquisition strategy necessitates, even mandates technology demonstrators for the foreseeable future. The aim of this article will therefore be to describe the acquisition strategy that is driving the flurry of ATDs and describe some of the more interesting projects.

## DOD Acquisition Strategy

On 29 January 1992, the US Department of Defence released its latest Fiscal Year 1993 budget. At \$267.6 billion, it represented a 3.7% cut from its last submission. It also cut Future Years Defence Plan (92 to 97), by over \$50 billion. In conjunction with cancelling many major weapons programmes (ADATS, TOW improved sights etc), a new weapons acquisition strategy was announced. "Due to the greatly-reduced Soviet military threat and declining defence spending" there was to be renewed and increased emphasis on research and development (R&D) and fewer production programmes. "DOD can afford to take more time in developing and evaluating new technologies before making decisions on weapons production." "The new strategy also emphasizes insertion of proven technologies into existing weapon systems over production of new weapon systems when technology insertion can meet operational needs."



CATTB Chassis.

With this type of decision, there is great fear in many circles, government and industry, that there will be a steady and non-reversible erosion in that portion of industrial base of the United States which traditionally support defence-related equipments. Canadians can remember what happened to their defence industrial base as a result of government policies of the 60's and 70's.

US Defence Secretary Dick Cheney is reported to have stated that the Army's current equipment inventory is adequate to meet any challenge in the foreseeable future. This position, coupled with a decrease in the procurement to R&D ratio for 93 to 1.5:1 has exacerbated these fears.

## The Trial of the ATD

Senator Malcolm Wallop (R-WY), a member of the Senate Armed Service Committee, quite correctly stated that, "Prototyping is not new... have always pursued research and development on technologies that were not necessarily headed directly for production. DARPA (Defence Advanced Research Projects Agency) was created specifically for such purpose."

Previously, (mid 80's) much of the R&D effort had been guided by Science and Technology Objectives (STOs) created by the Army leadership. However, they were constantly added to, and eventually they lost sight of the "objective" and the programme was cancelled. At this time, the concept of "Army Modernization Plans" emerged to try to fill the void created by the demise of the STOs. This conformed to a TACOM initiative which created a task force whose aim was to look at new technology with the objective of integrating it into a Technology Demonstrator.

The penultimate plan to date was the Technology Base Master Plan which guided technology insertion for all Army R&D. This was literally a contract between the Army and the different R&D centres to present the demonstration of a product by a given date. Based on this, funding was released to proceed with the work.

The latest thrust was effected in July of this year with the release of the Defence Science and Technology Strategy. A core dictum requires that technology be focused toward specific capabilities which can be demonstrated by an ATD. "Such a demonstration of capability,



coupled with simulations and exercises, will help to ensure that technology is ready, manufacturing processes are available, and operating concepts are understood before a formal acquisition program is undertaken." ATDs will either be of the type that demonstrate an "enabling" technology or concentrate on a new system or sub-system concept.

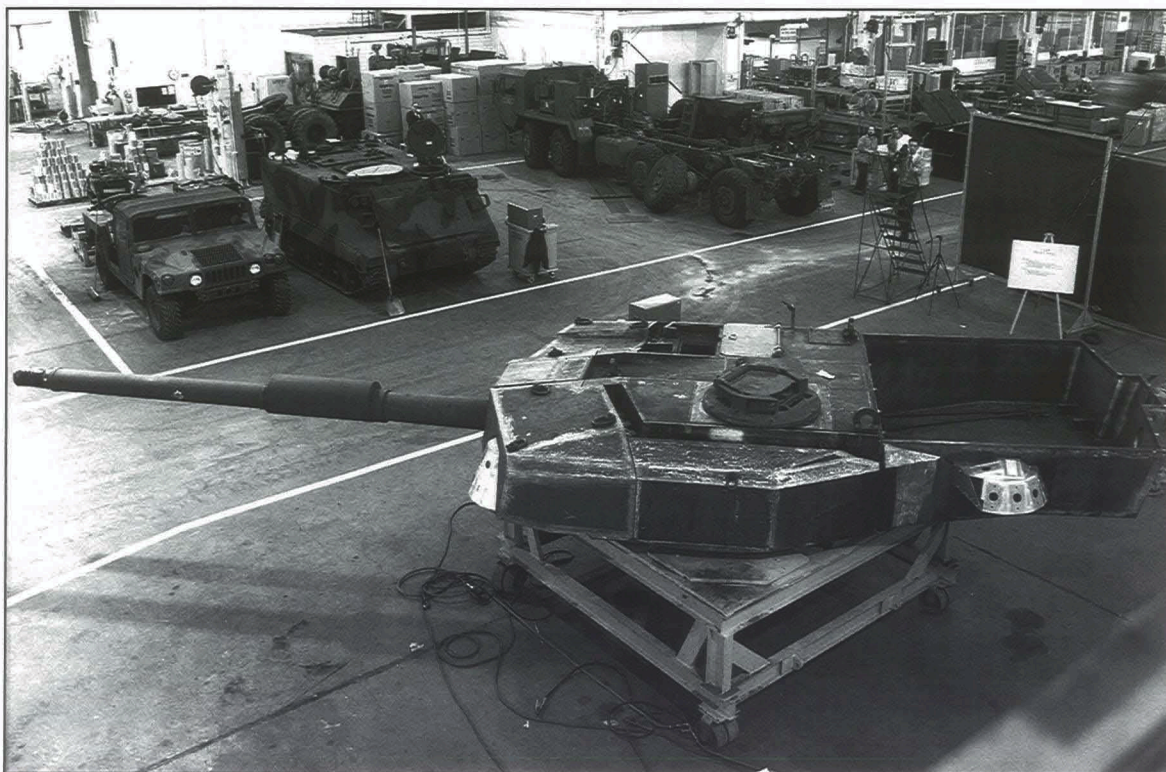
With regards to Senator Wallop's comments, the new issues of ATDs are their central position in the acquisition process, the depth and scope of the technology demonstrations and the changed emphasis to ultimately demonstrating military usefulness. Each programme will be "designed to satisfy decision makers that the technology is feasible, affordable and compatible with the operational concepts and force structure envisioned for the base force."

## Current Main-Stream Projects

### Component Advanced Technology Test Bed

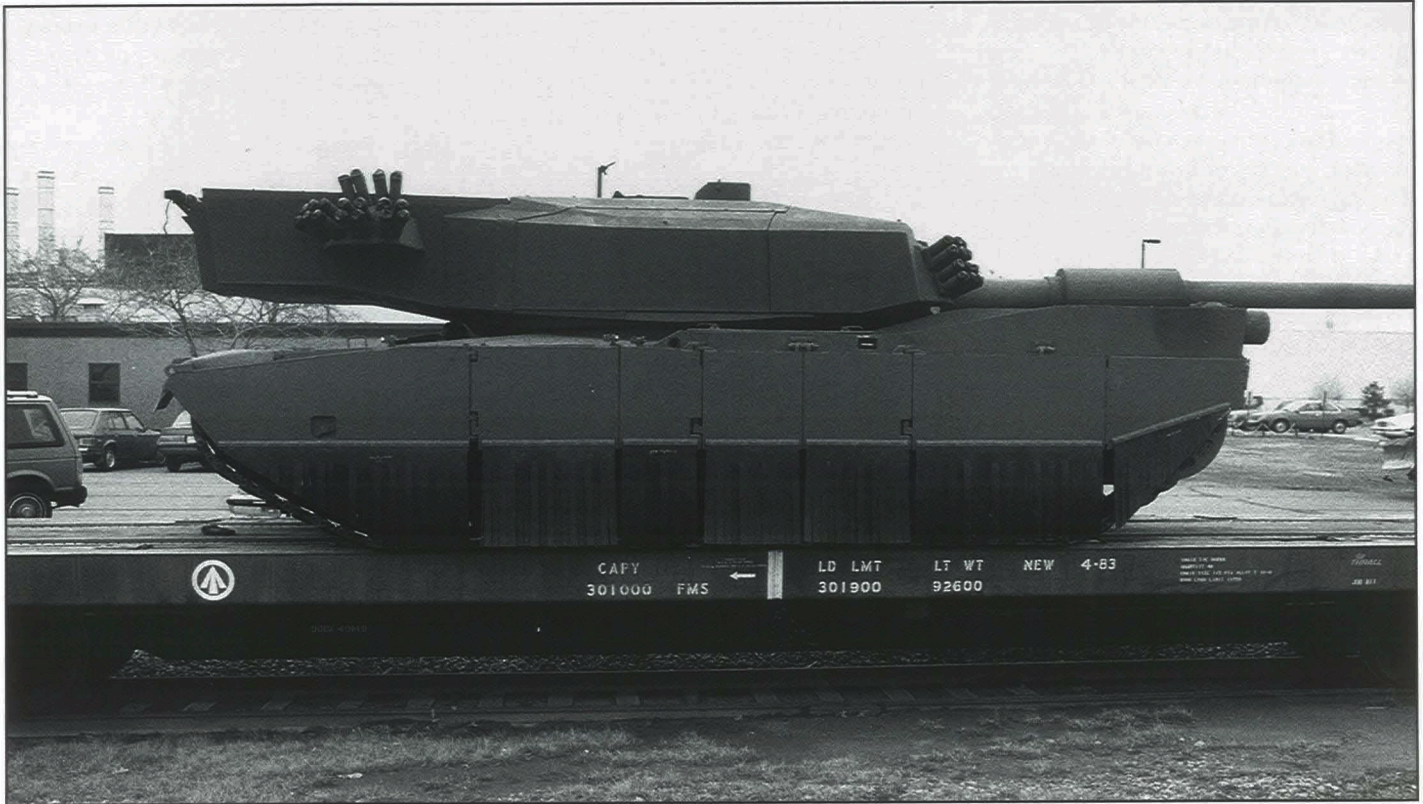
This is perhaps the premier project of its kind currently underway at TACOM, best known by its acronym CATTB. In its fifth year of activity, its goals are:

- a. **Reduce Programme Development Risk.** The now greatly-revised Armoured Systems Modernization Programme required answers to some of the harder technical problems in component development and integration through an early test bed programme;
- b. **Accelerate Technology Transfer.** Industry can benefit from and use the technology advanced on this project;
- c. **Vetronics.** Demonstrate the realities of integrating all the electrical/electronic requirements of a vehicle using the newly developed Standard Army Vehicle Architecture;
- d. **Simulation.** Develop and validate simulation techniques; and
- e. **Performance Specifications.** Develop and provide component and sub-system specifications to Project Managers for inclusion into Requests for Proposal.



CATTB Turret.





*The finished product!*

The key features/elements of this programme are:

- a. Advanced integrated propulsion system;
- b. Hydro-pneumatic in-arm suspension;
- c. Advanced track;
- d. Embedded training;
- e. Vetronics;
- f. Countermeasure technologies;
- g. NBC regenerative filtration system;
- h. Attachable modular armour;
- i. Combat vehicle command and control;
- j. Advanced weapon system; and
- k. Vehicle integrated defence system.

The work started with a basic M1 hull. At each design stage of the various components, simulation was followed with physical insertion to ensure fit into the allocated space. To date the following milestones have been achieved:

- a. Hydro-pneumatic suspension fitted (elimination of torsion bars has freed up a great deal of space);
- b. The electrical plans for components and installation have been released;
- c. The turret has been completed and mounted on an M1 chassis. Testing was completed at Aberdeen Proving Grounds and the results were encouraging.

- d. One of the two new engines has been received, installed and an initial run-up has been performed (again, great space savings have been achieved, still with 1500 HP output).

### 5 Ton Advanced Technology Transition Demonstrator

This programme is designed to demonstrate potential applications of mobility component technology to wheeled tactical vehicles. A 5 ton vehicle was chosen, but plans exist to try this approach on other classes of vehicles. The basic approach is to strip the in-service vehicle to the frame and install state-of-the art components.



Now in its second phase, the technologies to be trialed include a lightweight diesel engine (maximum weight 1300 lbs), air starter, anti-lock braking system, automatic 7-speed transmission with electronic control, and vetronics architecture. During testing there will be a side-by-side comparison with a USMC 5 ton truck with the TATRA suspension system.

### Composite Armoured Vehicle

TRADOC pamphlet 525-2 states, "...we must be prepared to project overwhelming combat power from the continental US in response to crisis." Lessons learned from the Gulf War include the fact that there is inadequate air- and sea-lift capability to meet contingency and global requirements. This has led to a rethink of the deployability and sustainability characteristics of all systems. Based on the lift capabilities of the air fleets from the C130

to the C141, a weight envelope of from 15 to 25 tons exists. Hence the technology demonstrator, the Composite Armoured Vehicle (CAV) is being targeted at this window.

To achieve lightness, yet maintain adequate survivability, composite structures are being investigated. Composites offer superior ballistic properties, have a high strength to weight ratio, improve blast load capacity, offer superior fatigue tolerance, are more corrosion resistant, eliminate spall, reduce signatures, and are more chemical resistant than traditional metals used in armour envelopes. Industry, particularly the aerospace sector, has used composite materials for many applications for some time.

The present phase of this multi-year project is concentrating on mechanical properties testing of multiple materials under various conditions. It will result in the development of fabrication and material placement methodology, cure process selection and tooling design.

Full-scale testing will be performed for ballistic qualification, material properties, and structural verification.

### The Future

The US Army is planning an Advanced Land Combat demonstration in 1998. George Singley, Deputy Assistant Secretary for Research and Technology, sees this as an opportunity to help officials understand if desired technology is ready for development or production. It will permit combat developers to assess the potential wartime value of the technology.

## Capt Scuka's Quote of the Day

*General Sir John Winthrop Hackett, in  
"War, Morality, and the Military Profession:"*

*"...But although militarism may be a suicidal perversion, though war may be bad, fighting may be bad, application of physical force among men may be bad (none of which is self-evidently true, but assuming it to be so), the military life, which would disappear if violence vanished among men, is in many important respects good.*

*Why this should be so is not difficult to see if we look at what have been called the military virtues... to quote Toynbee... 'they are virtues which are virtues in every walk of life... nonetheless virtues for being jewels set in blood and iron.' They include such qualities as courage, fortitude, and loyalty."*



# Project Control at 202 Workshop Depot

by B. Plante, Management  
Engineering Officer

In the past ten years, 202 Workshop Depot (202 Wksp Dep) has built credibility in the area of project management of major equipments, such as the Leopard tank and the Product Improvement of the APC family of vehicles. Recently, to maintain a productive, profitable, and competitive Workshop, some major changes have been introduced, such as the development of an integrated management information system, the implementation of an individual time accounting system, a cost accounting and performance measurement system, the initiation of a quality assurance project, and the introduction of a project management philosophy. These initiatives have allowed us to put in place a system of overall control and follow-up of projects at 202 WD.

## Definition

Before starting, it is imperative to define clearly what these terms, control and follow-up, imply. According to the dictionary, these are concurrent activities of monitoring and auditing which take place as an ongoing built-in process, having the specific goal of examining the value of something through facts analysis. This definition is very strict and implies the notion of close supervision, without considering any sharing of responsibilities. However, the new managerial approaches presently in use, which promote participative management, suggest a new definition of control and follow-up activities that integrates itself more readily with the present Unit mission.

## Approach

In fact, the 202 Wksp Dep approach regarding control is based on each Group/Work Team's individual responsibilities for the products to be delivered to

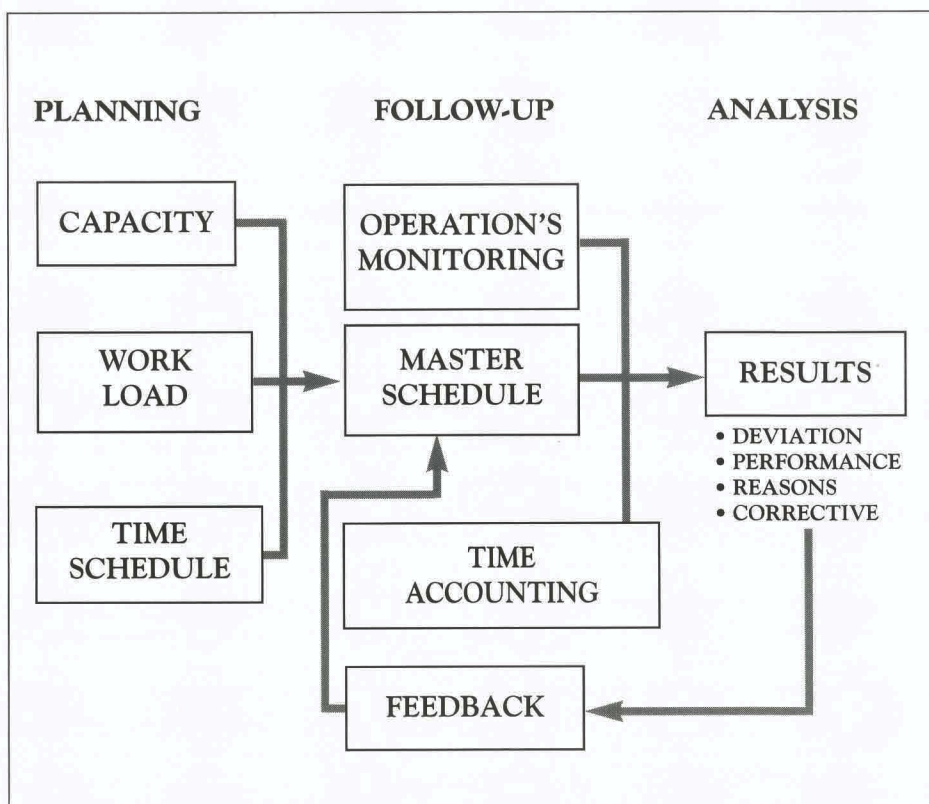


Table 1.

respective customers. To this end, each group must influence the decisions and nature of the expected results concerning them. This process then allows for the acceptance and clarification of same.

With this approach, the purpose of controlling is to provide to all levels information that will contribute to good decisionmaking, as well as development and application of corrective measures.

## The Control System

The diagram presented below depicts the actual system in use. In short, the control cycle takes place in three steps:

- Planning**, which triggers the process by integrating the workload, the time schedule, and the workshop capacity for a specific period. This allows production of a detailed master schedule of all the activities concerned. This schedule then becomes the key to the control and follow-up of a project, as it contains all pertinent information;
- Follow-up**, which takes place after a project is underway, with the aide of two distinct sub-systems, namely the Progress Monitoring System regarding components and/or groups of equipments, and the Time Accounting System. These systems automatically produce information on the actual progress of the project. This information is then input to the master schedule, allowing the project manager to



readily visualize the global performance, as well as deviations from objectives; and

- c. **Analysis and feedback**, at the tail end of the cycle, where the results obtained are compared with the objectives, the causes of deviations are identified, appropriate corrective measures are developed, and the master schedule is revised if necessary. It follows that analysis is done in conjunction with the Project Managers and the Production Sections concerned.

## Reports

The auditing of results versus objectives takes place through periodic personalized reports, allowing the users to be informed on their projects. The three following tables reflect the types of reports used to analyse results:

- Project Progress by Work Centre (Table 1), which is tailored for foremen and workers, informs them of the real progress made versus their plan in terms of the percentage of planned time completed for the particular date;
- Work Progress on Vehicles (Table 2), which informs Project Managers and Shop Supervisors of the progress of a group of vehicles versus the master schedule. This allows them to follow the progress of each vehicle; and
- Project Time Report (Table 3), where various cumulative planned or reported hours to date appear. These cumulative time elements are available for a whole project, for one division, and for each work centre. In fact, four values are derived:
  - Cumulative Planned Time (TPCUM), which represents planned hours according to the master schedule;
  - Actual Planned Time (TPACT), which represents the cumulative value of the **planned hours** for all completed operations; then, if the TPACT is larger than the TPCUM the project is ahead of plan;
  - Actual Reported Time (TRACT), which represents the **actual hours** reported on all completed operations; then, if the TRACT is smaller than the TPACT the work is being done efficiently; and

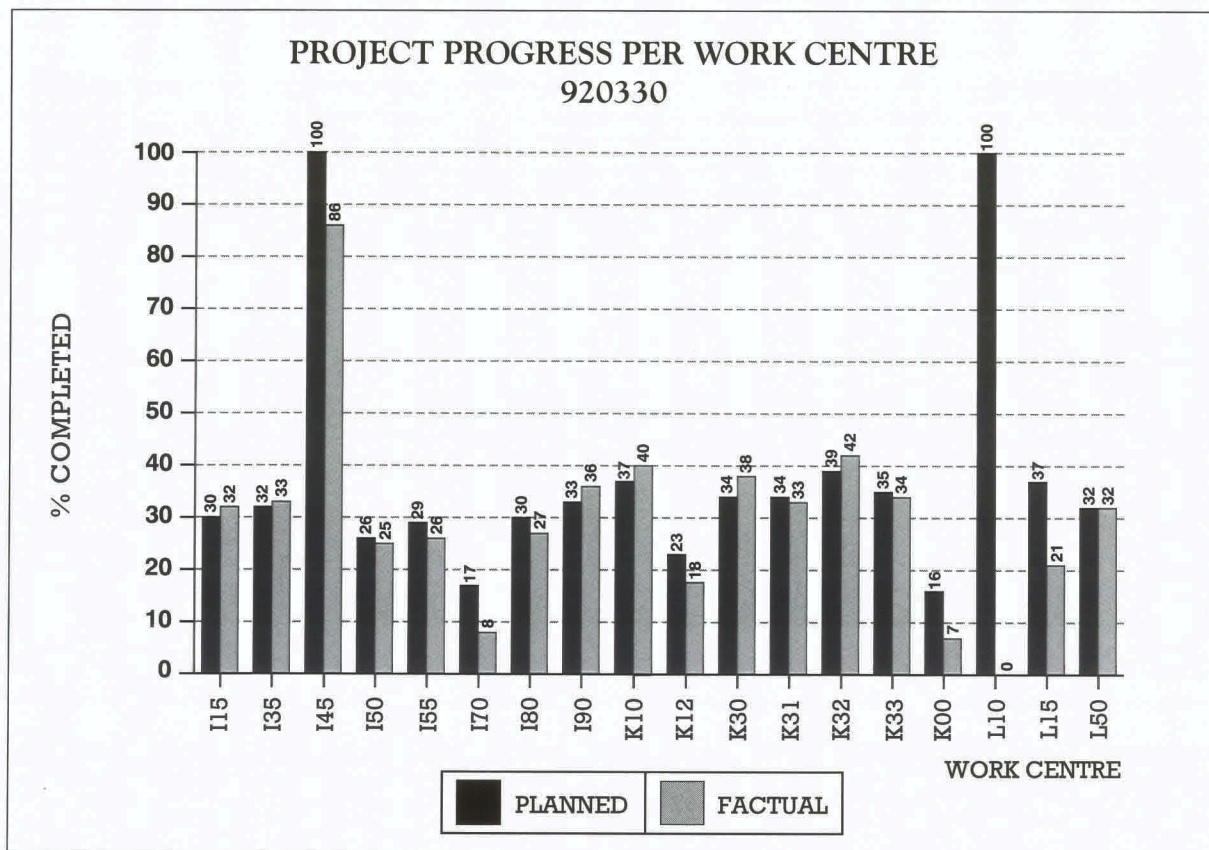


Table 2.



- (4) Total Time Reported (TRTOT), which represents the total hours reported to date, and allows evaluation of the whole of the activities in progress as well as what is pending.

## Conclusion

The pursuit of this participative approach by all users, as well as the philosophy of providing quality decision-making data at all times, allows us to identify the source of deviations from the plan, and to implement corrective measures to minor problems. This reduces the transit time of equipment at 202 Workshop, while reducing repair costs and maintaining the Quality Standards which are our trademark.

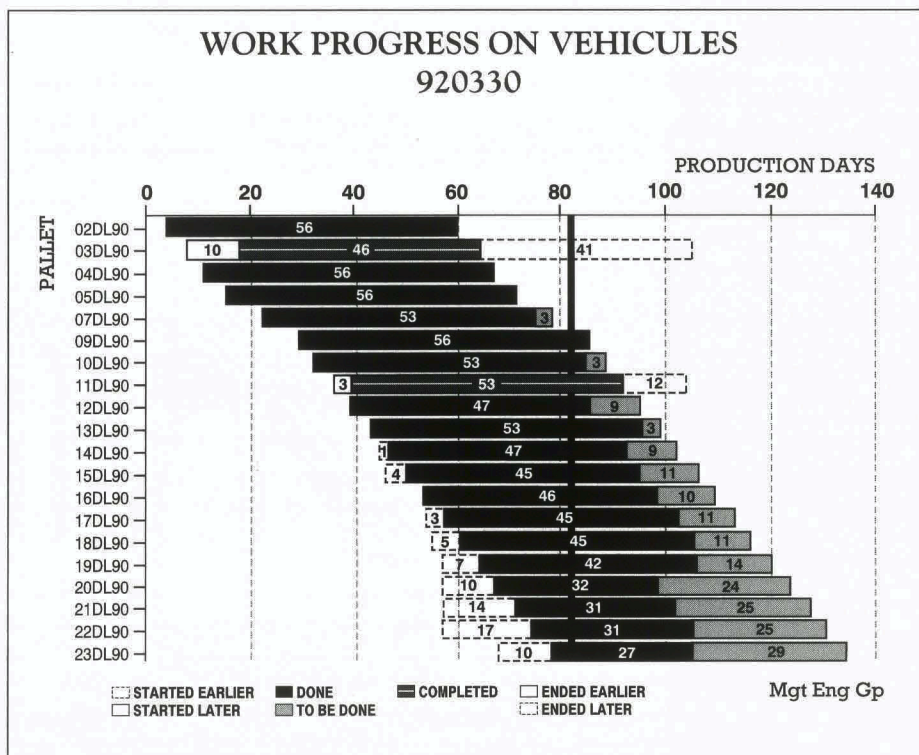


Table 3.

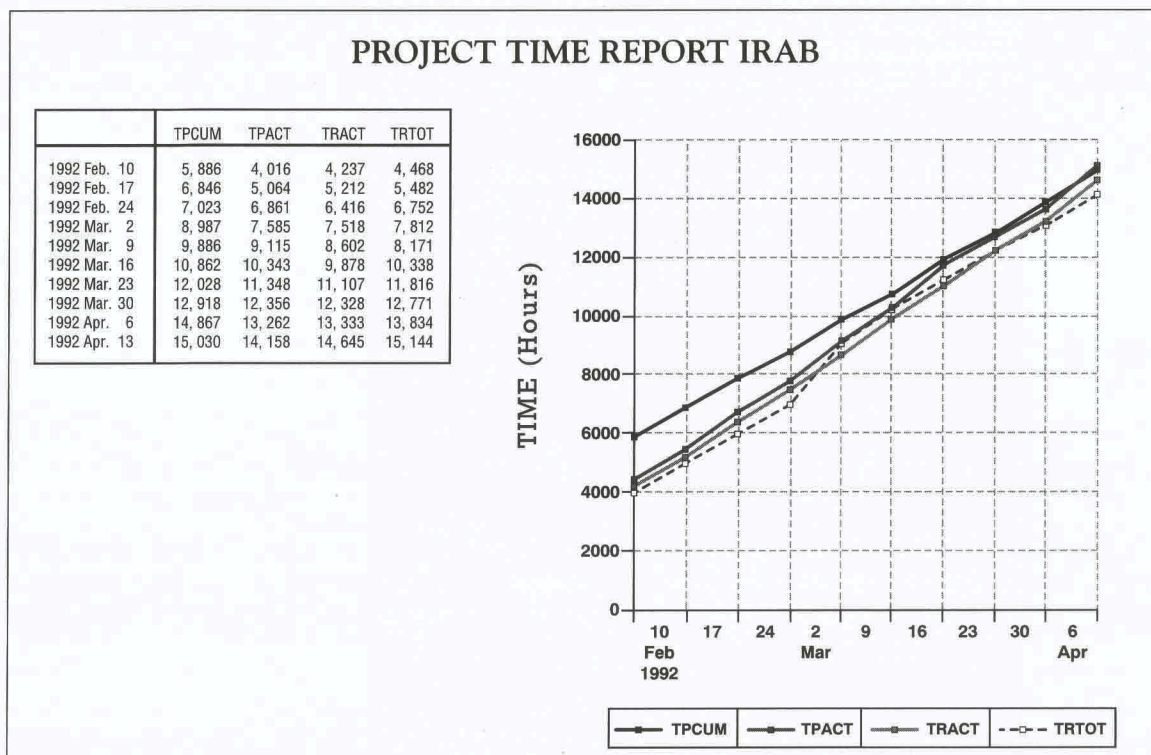


Table 4.



# The Geographical Challenge

by Capt Dickson

Although CFB Greenwood is located in the beautiful Annapolis Valley, the tranquil setting of the base is very deceiving. It is one of the largest bases in Air Command, and is under the operational control of Maritime Air Group. Greenwood is home to three Aurora Squadrons and 413 Transport and Rescue Squadron. There are approximately 2600 military and civilian personnel employed on the base, which is by far the largest employer in the area.

The BEME section consists of 36 personnel. We are basically organized according to 314(6), with some modifications to accommodate the many locations of our customers. Like many Air Command bases we provide support to Navy, Air and Land as well as Cadets and Rescue/Militia units. The list of units to be supported continues to grow; recently the coastal radar sites of Barrington and Sydney were added.

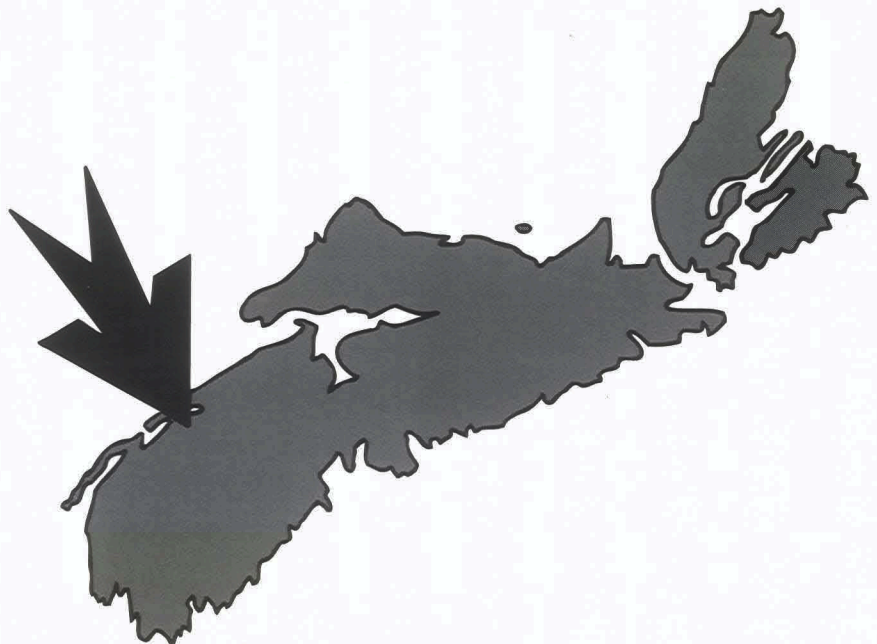
The location of our many dependencies makes for a busy ATI schedule. The organization to conduct the annual visit to Bermuda is in itself a difficult task. When you try to time Air Canada flights to the availability of equipment and quarters, it is sometimes a difficult balancing act. There is, however, no lack of volunteers to carry out the ATI. The remainder of our areas of responsibility are not quite so glamorous but every bit as important. The West Nova Scotia Regiment in Camp Aldershot and Middleton, Windsor, as well as Camp Aldershot itself, make up the rest of our major commitment in the valley. Two of our personnel are deployed in Camp Aldershot year round. I would be remiss, however, if I did not include our most northerly customer, CFL0 Keflavik, Iceland. This mainly-paper support is provided by the control office, and includes such things as paying the local contract bills for the Volkswagen fleet

and keeping track of the REL's. So far this winter the ETSM has not requested an ATI visit. I think the trip to Bermuda has spoiled him.

The control office staff has been very busy this past year. During the fall of 1991 the fire trucks were diagnosed as requiring a major overhaul. After the usual search for companies to undertake the project, and the standard involvement from SSC, a firm was selected. It was only after disassembly that the real extent of the corrosion was evident. The repairs have turned into a two year effort, and the cost will be approximately \$160,000.00. The ravages of road salt and the chemicals used in the foam have had a devastating effect. Also, the use of dissimilar metals caused a good deal of corrosion in places where it is not normally found. Needless to say, the contracts NCM and the ETSM have been busy visiting the repair facility to ensure this does not happen again. The three vehicles we have had repaired to date are high quality. The small valley company who won the contract can be justly proud of their work.

All indications are that CFB Greenwood will be here for some time to come. With this in mind, we in BEME have undertaken our most ambitious project to date and are working on a consolidation plan; that is to say a hangar of our own. As with many Air Command bases our personnel are employed in multiple locations. The plan is currently past the drafting stage, and it will be submitted to Air Command for approval. If approved, it will enable the BEME section to employ all its personnel under one roof with the exception of AMSE and refuelling repair. For obvious reasons, these repair functions must remain in location with the equipment. The lack of modern facilities has never deterred EME Craftsman, and the folks at CFB Greenwood are no exception.

From fire trucks to SAR boats, to weapons and canvas and all that falls in between, the diversity of equipment boggles the mind. However, from the smallest to the largest they all receive the same degree of expertise and attention. As the saying goes in the shop "If it doesn't fly or talk we fix it". The BEME section's reputation as the can-do people is well deserved.





# Santa's Workshop in Montreal!

by Capt N. Brely

This past fall, 202 Workshop civilian and military employees repaired, on a voluntary basis after working hours, some 2000 Christmas toys for needy children in the Montreal region. These toys were part of baskets prepared by the Montreal Fireman's Association Christmas campaign, and were distributed to needy families on 21 December 1993.

202 Workshop management allowed the employees to use facilities, tools, equipment, and warehouses in order to devote themselves to this noble cause. Some employees even worked at home.

The expertise of 202 Workshop employees greatly facilitates the annual toy repair, as the types of toy range from a simple "teddy bear" to a remote control car. An important point: in selecting the toys to repair, all violence-related toys were discarded. As Mr Francois Bussières, the campaign project manager, said: "Christmas is a celebration of Joy and Love; there is no place for violence."

This was the second year for 202 Workshop participation in the Christmas Toy Repair project. This campaign has been a very enriching experience for all who took part, and it is certain that all look forward to doing it again next Christmas...



Nicole Millum, Montreal municipal councillor; Michel Lacroix, 202 WD Adm O; Francine Lalonde, MP of Mercier riding; Francois Bussieres, Toy Repair Project Manager; during hand-over of the toys to Montreal firemen on 15 December 1993.



Colonel Yves St-Laurent, CO 202 WD, and Francois Bussieres with Santa Claus during the toy hand-over.



# Land Software Engineering Centre

*Editor's Note: With the recent announcement of the LETE closure, the future of LSEC has not been determined.*

The Army is making increasing use of software in weapon and command and control systems; software which must be supported throughout its life cycle. The LSEC has been established to assist DGLEM LCMMs in providing cost-effective support to the software contained in weapon systems. This role comprises the following major functions: Maintenance of software; Design and Development of software; Management of software engineering; Provision of advice on software engineering; and Research and development.

The LSEC is defined by DGLEM Division Instruction 2/91 Life Cycle Management of Land Tactical Software. This instruction requires all projects involved with software to draw upon LSEC expertise during project planning phases. This instruction also tasks the LSEC to provide in-service support to land tactical software. The LSEC must also follow external policies and instructions. Foremost among these is NDHQ Policy Directive P1/88. This policy directs the use of "Ada" for all weapon systems software development for which the Department will assume life cycle support responsibilities. The LSEC is involved in all aspects of the insertion of Ada technology in the land forces. This includes technology tracking, Ada software project management, and assistance to DGLEM staff with requests for waivers from the policy.

Effective 29 November 1993, the LSEC was re-assigned from DLAEEM to LETE, to become S Squadron. The LSEC organization is structured as a maintenance workshop with an administration and finance section, a control and engineering section, and a production section. The LSEC has a current staff of 10 DND personnel, and has operated in

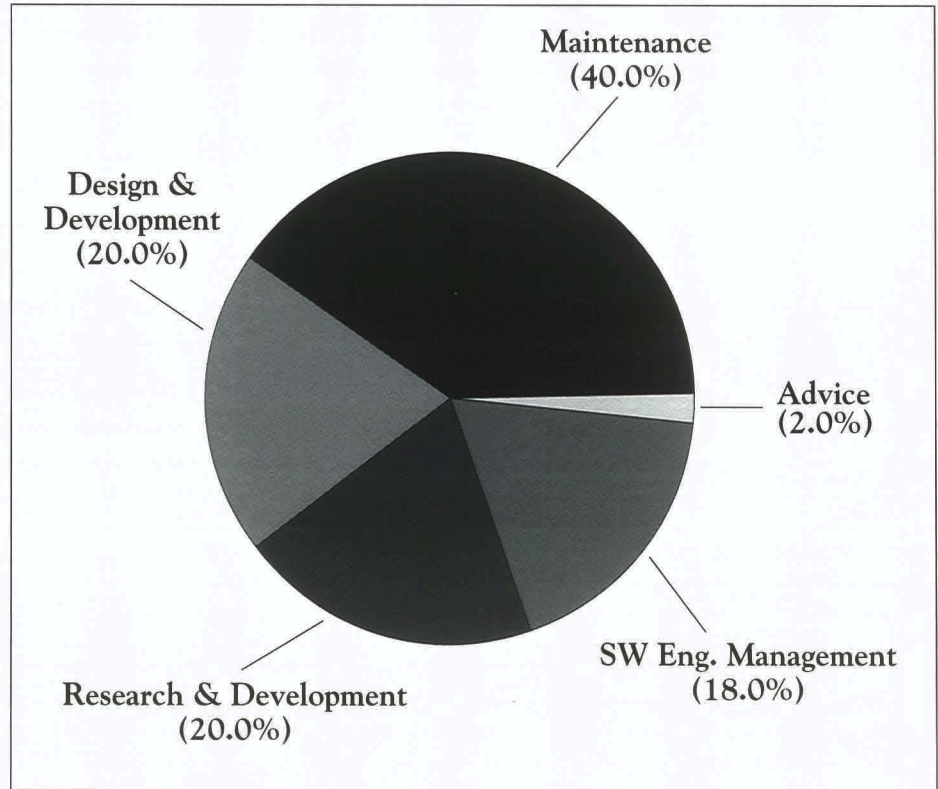


Figure 1. LSEC Workload Breakdown.

the DND Computer Centre (DNDCC) in Tunney's Pasture since May 92. The current facility was opened by BGen Fischer 26 June 1992.

The majority of the labour required to accomplish the engineering and production roles of the LSEC is provided through services contracts. The total staff requirements vary depending on the task loading, but averaged 34 TIES personnel during the past year. The contracts call for the provision of software engineering services in three areas: Military and Training Systems; Command and Control Systems; and Engineering Management Services.

The workload of the LSEC for the last year, in terms of percentage of person hours expended by function, is broken down as follows:

Here are some examples of the type of work the LSEC has been doing over the last year:

**NODLR** – The Night Observation Device Long Range is a system that includes a Fault Diagnostic Unit (FDU) to assist the second line Fire Control Technician (Optronic) to get information from the Thermal Observation Device (TOD) Built In Test Equipment (BITE). The LSEC received a maintenance tasking for this software because it was very awkward to use. The FDU software was originally written by SPAR as a factory test device, never intending to be fielded. It was written in Basic and was virtually undocumented. Given the state of the software, it was decided that the best solution was to completely re-engineer the application.

The new FDU software has recently undergone user acceptance tests with very favourable results. The software resides on a Gridcase 1550 SX lap top computer, and works in a Microsoft Windows



environment. It is entirely written in Ada, which as a real time system in Windows, means the LSEC was breaking new ground with this application. It features high quality on-line help information, a greatly improved user interface, and the ability to obtain reading updates upon request.

From the user test report the main advantages of the new software are that:

- a. it provides a better view of what is going on during testing, especially during period of internal activity without external indications;
- b. it allows for a faster in inspection of equipment as one of the options in the menu directly offers a check of equipment condition; and
- c. it allows for easier and faster adjustment activities on components of the TOD because of the option offered to directly update readings.

In short, the new software was found to be easy to set up and use, user friendly, and have improved diagnostic, fault finding, and fault isolation capabilities.

**ACS** – The Artillery Calibration System is a Grid notebook computer which interfaces directly with Muzzle Velocity Indicator (MVI) to download stored muzzle velocities. Once downloaded, the ACS is used to upload the data to the Calibration Cell (currently

the LSEC) for analysis to produce gun barrel fleet muzzle velocities to be used by the MiliPAC.

The LSEC has been supporting the current fielded version, and is currently expanding the ACS role to include the Calibration Cell software which will perform statistical analysis on MVI data and will produce MVs based on series shoots, multiple series shoots, or wear /Effective Full Charge (EFC) versus MV trends. This data will be sent to the Regiment Computer Software Configuration Item (CSCI) as MVs or MV tables which will be used to generate MiliPAC MV records for each barrel /charge/projectile combination. The project is reaching its detailed design stage and should be completed by Aug 93. The reduced muzzle velocity (RMV) algorithm has been found by reverse engineering the MVI code. The same will be done with the MiliPAC code to verify the algorithms are the same. This is required because CDC never delivered the RMV algorithm and for business reasons will not. Director Mathematics and Statistics (DMS) is waiting for the correct RMV algorithm from the ACS project in order to complete the statistical model for the calibration cell CSCI.

**MMS** – The Maintenance Management System data base application is intended to assist maintenance organizations with the management of workload and of valuable resources, namely time and personnel. This system allows managers

at all levels to input workshop operations data and produce a wide variety of management reports for internal use and for submission to LOMMIS organizations.

The MMS was passed to the LSEC in Aug 92 by DLES. The LSEC's first task was to become familiar with the project, reverse-engineer the product and start the documentation. The second task was to test the single version 4.3 (FoxBase) software (74 bugs found). The Third task for 93 will be to debug (400 bugs found), test BETA version (Aug 93), and field, version 5.0 (LAN ver FoxPro 2.0).

In concluding, the LSEC has reorganized, moved, and received new contractor personnel during the last year. The influx of new DND and contractor personnel has created an urgent need to develop a software engineering process particular to the LSEC to channel the efforts of personnel of different backgrounds. This is under way, and will improve the quality of the software produced and reduce costs. The coming year will see an increase in workload and an increase in production as procedures and tools become more readily available.



The Electrical and Mechanical Engineering Branch history

# CANADA'S CRAFTSMEN

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